ADVANTEST®
ADVANTEST CORPORATION

INSTRUCTION MANUAL TR4172 SPECTRUM ANALYZER VOL-1

MANUAL NUMBER ED01 9509

Relation manual
TR4172 VOL-2

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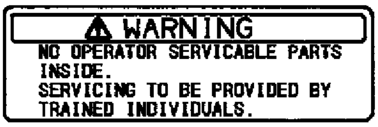
Safety Summary

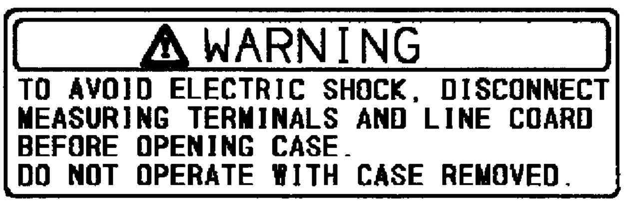
To ensure thorough understanding of all functions and to ensure efficient use of this equipment, please read the Instruction Manual carefully before using. Note that Advantest bears absolutely no responsibility for the result of operations caused due to incorrect or inappropriate use of this equipment.

Careful attention to personal safety should be paid when operating and servicing this equipment. Please be sure to always use this equipment correctly and safely.

■Warning Labels

Warning labels such as shown below are applied to Advantest products in locations where specific dangers exist. Pay careful attention to these labels during handling. Do not remove or tear these labels. If you have any questions regarding warning labels, please ask your nearest Advantest dealer. Our address and phone number are listed at the end of this manual.





■Basic Precautions

Please observe the following precautions to prevent fire, burn, electric shock, and personal injury.

●Use a power cable rated for the voltage in question. Be sure however to use a power cable conforming to safety standards of your nation when using a product overseas. Do not place anything heavy on top of the power cable.

●When inserting the plug into the electrical outlet, first turn the power switch OFF and then insert the plug as far as it will go.

●When removing the plug from the electrical outlet, first turn the power switch OFF and then pull it out by gripping the plug. Do not pull on the power cable itself. Make sure your hands are dry at this time.

●Before turning on the power, be sure to check that the supply voltage matches the voltage requirements of the equipment.

●Be sure to plug the power cable into an electrical outlet which has a safety ground terminal. Grounding will be defeated if you use an extension cord which does not include a safety ground terminal.

●Be sure to use fuses rated for the voltage in question.

●Do not use this equipment with the case open.

●Do not place any heavy objects on top of this equipment. Also, do not place flower pots or other containers containing liquid such as chemicals on top of or near this equipment.

●Do not stick or drop metal or easily flammable objects into the ventilation outlets of this equipment.

●In the case of products which emit laser light, do not look directly at the output connector edge or the connected fiber output edge.

■Caution Symbols Used Within the Instruction Manual

Symbols indicating items requiring caution which are used in this instruction manual are shown below together with their meaning.

DANGER : Indicates an item where there is a danger of serious personal injury (death or serious injury)

WARNING : Indicates an item relating to personal safety or health

CAUTION : Indicates an item relating to possible damage to the product or equipment or relating to a restriction on operation

■Safety Marks on the Product

The following safety marks can be found on Advantest products.

 : Indicates that care in handling is required. A reference to the appropriate pages in the instruction manual is given to protect yourself and the product.

 : Represents a ground symbol. This indicates field wiring terminals which must be grounded before using the equipment to prevent electric shock.

 : Indicates dangerous high voltage. This is placed at locations where 1000 volts or more is input or output.

 : Indicates a frame (or case) terminal. This is placed on terminals connected to the outside frame (or case) of the product.

 : Indicates alternating current (current or voltage).

 : Indicates direct current (current or voltage).

 : Indicates alternating current (current or voltage) and direct current (current or voltage).

■Precautions when Disposing of this Equipment

Be aware of the following harmful substances when disposing of this product and be sure they are disposed of properly. If you have questions on how to dispose of this product, please contact your nearest Advantest dealer. Our address and phone number are listed at the end of this manual.

Harmful substances:

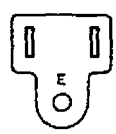
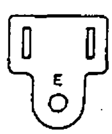
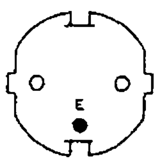
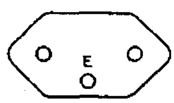
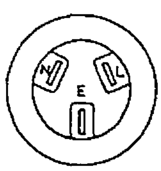
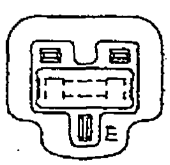
(1) PCB (polycarbon biphenyl)
(2) Mercury
(3) Ni-Cd (nickel cadmium)
(4) Other
Items possessing cyan, organic phosphorous and hexadic chromium and items which may leak cadmium or arsenic (excluding lead in solder).

■Replacement Parts

Some parts used in this equipment are expected to wear out over time due to friction or other causes. Please replace these parts periodically to ensure a set level of performance. If you have questions about replacement parts, please ask your nearest Advantest dealer. Our address and phone number are listed at the end of this manual.

NOTICE

*ADVANTEST provides the following power cables for each country.
If there was any inconvenience on your use, please contact our subsidiaries or ADVANTEST representatives.*

	Plugs	Standards/Countries	Ratings/Color/ Length	Accessory Codes
1		JIS : JAPAN	Rating :125V 7A Color :Black Length :2m	A01402 A01412
2		UL : USA CSA : CANADA	Rating :125V 7A Color :Black Length :2m	A01403 (Opt.95) A01413
3		CEE : EUROPE VDE : FRG OVE : AUSTRIA SEMKO : SWEDEN DEMKO : DENMARK KEMA : NETHERLANDS FIMKO : FINLAND NEMKO : NORWAY CEBEC : BELGIUM	Rating :250V 6A Color :Gray Length :2m	A01404 (Opt.96) A01414
4		SEV : SWITZERLAND	Rating :250V 6A Color :Gray Length :2m	A01405 (Opt.97) A01415
5		SAA : AUSTRALIA NEWZELAND	Rating :250V 6A Color :Gray Length :2m	A01406 (Opt.98)
6		BS : UK	Rating :250V 6A Color :Black Length :2m	A01407 (Opt.99) A01417

Note : "E" shows earth (ground).

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SECTION 1
GENERAL INFORMATION

1-1. GENERAL

The TR4172 Spectrum Analyzer is a microprocessor-controlled, intelligent instrument with a frequency range from 50 Hz to 1800 MHz.
In addition to the spectrum analyzing function, the integrated tracking generator of TR4172 enables analysis of frequency response of filters, amplifiers, and so on.
TR4172 is the first spectrum analyzer with a capability for measuring phase response and group delay of filters or amplifiers at resolutions of down to 0.1 deg and 0.1 ns respectively, up to a frequency of 1800 MHz.
The integrated tracking generator, along with the analyzer's intelligent control capability, permits correction of the analyzer's frequency response itself allowing precision level measurement.
A wide dynamic range is ensured by the low higher-harmonic distortion level of 90 dB at and above 20 MHz, with respect to a signal level of -40 dBm.
The display screen has a dynamic range of more than 95 dB and permits direct observation of filter responses with large attenuations.
The vertical resolution of the scale can be selected from 10, 5, 2, 1, and 0.1 dB per division. Observation of a ripple level of even 0.01 dB is possible with the maximum resolution setting.
Use of the SAVE switch makes various measurements available, with which up to eight sets of measurement condition data are stored in the internal registers and recalled as needed. Since the internal memory is backed up by a battery, its contents remain intact even if the device is unplugged from its supply outlet.
All front panel functions are remotely controllable with the GPIB interface (standard supply) for automatic measurement.

The CRT display presents all pertinent measurement data. The signal response trace and measurement data on the screen can be output to an X-Y plotter simply by connecting the instrument's GPIB connector to the plotter's input with a GPIB cable and operating the relevant front-panel switches, without the need for running an output program on the GPIB controller.
TR4172 also provides various convenient features to enhance measurement flexibility and efficiency, such as multiple marker, zoom, automatic centering, automatic enlargement, auto-peak search, logarithmic scaling, and four page memorized display.

1-2. FEATURES

(1) Spectrum, amplitude, phase and group-delay measurement capability at resolutions of down to 10 Hz, 0.1 dB/div., 0.2 deg/div., and 0.1 ns/div. respectively.
(2) Wide dynamic range of 90 dB at -40 dBm input level (above 20 MHz).
(3) CRT screen with a large display dynamic range of more than 95 dB permitting direct observation of large attenuation responses.
(4) Simultaneous four trace display allowing waveform comparison.
(5) Multiple marker.
(6) Automatic correction of bandwidth switching error, step amplifier switching error, and frequency response error.
(7) Scaling the horizontal graticule divisions in logarithmic scale.
(8) Output to an X-Y plotter supported without the need for the external GPIB controller.
(9) Remote operation of all front panel functions via the external GPIB interface facility (standard supply).
Reading capability for measurement data and labels on the screen and writing capability for characters and data on the screen.

1-3. ACCESSORIES SUPPLIED

The standard accessories supplied with the instrument are listed below. Check the quantity and specifications of the accessories against this listing:

(1)	Fuse	MDX-1A	2
(2)	Fuse	MDA-1.25A	2
(3)	Allen wrench	3 mm	1
(4)	Input cable	MI-02 (UG-88/U plug, BNC-BNC)	2
(5)	Input cable	MI-04 (UG-21D/U plug, N/H)	2
(6)	Input cable	MC-61 (UG-88/U plug, BNC-BNC)	1
(7)	N-BNC plug adaptor	JUG-201A/U	2
(8)	BUS cable		1
(9)	RF interconnecting cable		1
(10)	IF interconnecting cable		1
(11)	Power cable		2
(12)	Instruction Manual		1

1-4. SPECIFICATIONS

(1) FREQUENCY SPECIFICATIONS

Frequency range : 50 Hz to 1800 MHz
DC coupled: 50 Hz to 1800 MHz
AC coupled: 10 kHz to 1800 MHz

Frequency span : 100 Hz to 1800 MHz on 10 divisions of the CRT horizontal axis graticule.
Enterable with the DATA knob or DATA number/unit keyboard in two significant figures.
Controllable with the DATA step keys in a 1, 2, or 5 steps.
At zero frequency span mode, the analyzer functions as a fixed tuned receiver.

Frequency span accuracy: Better than ±3% for span > 500 kHz.
Better than ±5% for span ≤ 500 kHz.

Center frequency : 0 Hz to 1800 MHz variable with the DATA knob, DATA step keys, or DATA keyboard.
The center frequency can also be set with the MKR → CF or SIGNAL TRACK key.
Center frequency step size can be controlled with the CF STEP SIZE or MKR/Δ → STEP SIZE key.

Center frequency accuracy: ±(1% of frequency span + 20 Hz)

Marker

NORMAL : Provides direct frequency readout of the marker point.
Accuracy: Center frequency accuracy plus frequency span accuracy between the marker and center frequencies.

T.G. CNTR : Provides direct readout of the marker frequency.
Accuracy: Equal to the center frequency accuracy.

FREQ. CNTR : Provides direct readout of signal frequency the level of which is more than +15 dB higher than the noise level.
Accuracy: (Reference frequency accuracy) x (frequency readout) ± (2 counts) for signal frequencies from 400 kHz to 1500 MHz.

Reference Oscillator Stability:

Aging Rate	1×10^{-8} /month
Long-term stability	2×10^{-8} /year
Temp Stability ($0^{\circ}C$ to $40^{\circ}C$)	$\pm 5 \times 10^{-9}$

SIGNAL TRACK : Maintains a drifting signal and the marker at the center of the display.

Δ(delta) : Provides direct readout of a frequency difference between two markers.

ZOOM : With use of the DATA step key $\boxed{\downarrow}$, reduces the frequency span while centering the marker.

Resolution

Resolution bandwidth (3 dB bandwidth):

10 Hz to 1 MHz in a 1-3 sequence.

Bandwidth accuracy: ±20%

60/3 dB resolution bandwidth ratio:

10:1 in 1 MHz, 300 kHz

13:1 in 100 kHz to 10 Hz

Stability

Residual FM component: 2 Hz p-p/1 sec or less; frequency span < 50 kHz

Frequency stability: 30 Hz p-p/min.; frequency span < 50 kHz (at a constant temperature after 1 hour of warm-up)

Noise sideband : -75 dB or less at 20 kHz apart from the carrier, with resolution bandwidth of 1 kHz and video filter bandwidth of 1 Hz.

-80 dB or less at 30 kHz apart from the carrier, with resolution bandwidth of 1 kHz and video filter bandwidth of 1 Hz.

(2) AMPLITUDE SPECIFICATIONS

Measurement range : -130 dBm to +20 dBm (INPUT 1)

-150 dBm to -30 dBm (INPUT 2)

Display range : Logarithmic scale (with respect to the reference level): 95 dB at 10 dB/div.

50 dB at 5 dB/div.

20 dB at 2 dB/div.

10 dB at 1 dB/div.

0.8 dB at 0.1 dB/div.

Linear scale (calibrated in voltage):

10%/div. of the reference level at LIN x 1

5%/div. of the reference level at LIN x 2

2%/div. of the reference level at LIN x 5

1%/div. of the reference level at LIN x 10

Linearity

Logarithmic : ±0.2 dB/1 dB over 0 dB to 95 dB

Max. ±1 dB over 0 dB to 95 dB (20°C to 30°C)

Max. ±1.5 dB over 0 dB to 95 dB (0°C to 40°C)

Linear : ±3% of the reference level

Reference level

Reference level readout:

Logarithmic:

+50.0 dBm to -90.0 dBm (readout in units dBμV)

Linear: 70.7 V to 7.07 μV

Reference level readout accuracy: Max. $\pm$1 dB after calibration and error correction

Calibration output accuracy: -20 dBm $\pm$0.3 dB (Guaranteed at the CAL. OUT. connector)

(50 MHz) $\pm$ (50 MHz x reference oscillator accuracy)

Frequency response: Within $\pm$0.7 dB over 400 kHz to 1800 MHz (after error correction)

Marker

NORMAL : Provides readout of the amplitude at an active marker.

PEAK SEARCH : Positions the marker to the peak of the largest signal.

NEG. PEAK SEARCH : Positions the marker to the peak of the smallest signal

NEXT PEAK SEARCH : Positeons the marker from the peak of the largest signal to the next largest

MKR → REF : Brings the reference level equal to the marker level.

Δ(delta) : Provides readout of the level difference between two markers.

Multiple marker points: Up to 10 points

DISPLAY LINE : A horizontal display line traces amplitude readout.

Dynamic range

Spurious response : -80 dB or less at -30 dBm input with center frequency $\geq$ 1 MHz

-60 dB or less at -30 dBm input with center frequency $<$ 1 MHz

Average noise level: INPUT 1 -130 dBm or less
INPUT 2 -150 dBm or less
at a resolution bandwidth of
10 Hz, video filter bandwidth of 1 Hz, and center
frequency of 1 MHz or above

Residual response : -100 dBm or less

Gain compression : 1 dB or less at 0 dBm input

(3) SWEEP SPECIFICATIONS

Sweep time : 50 ms to 1000 sec
100 μs to 1000 sec at zero frequency span mode

Trigger mode : INTernal, LINE, EXTernal, VIDEO, and SINGLE

(4) INPUT SPECIFICATIONS

INPUT 1

RF input : N type connector, 50 Ω

Maximum input level: +20 dBm (Input attenuator 20 dB or more)
DC coupled: 0 VDC max.
AC coupled: ±25 VDC max.

Input impedance : 50 Ω, VSWR 1.5 or less (at ATT ≥ 10 dB)

INPUT 2

RF input : BNC type connector, 50 Ω

Maximum input level : -30 dBm ±20 VDC max.

Frequency range : 10 MHz to 1000MHz

Amplification : 25 dB or more

Flatness : 3 dB p-p

Input impedance : 50 Ω, VSWR 1.5 or less (at ATT ≥ 10 dB)

Input attenuator : 0 to 50 dB attenuation at 10 dB step

Input attenuator accuracy : ±1 dB (at ATT ≥ 20 dB, referenced to 10 dB)

(5) DISPLAY SECTION SPECIFICATIONS

Display : Graticule, waveform, measurement data, and label

Trace : 4 trace memories for traces A, B, A', and B'
When trace memories A and B are used, the number of data points on the horizontal graticule is approx. 1000, and vertical resolution is 0.1%.
When trace memories A' and B' are used, the number of data sampling points on the horizontal graticule is approx. 500.

	Contents of the memories are displayed on the CRT at a rate independent of the analyzer sweep rate.
WRITE mode	: Analyzer's response is stored and displayed for each sweep.
MAX HOLD mode	: Stores and displays the maximum signal level at each horizontal point.
VIEW mode	: No updating of the trace memory is made, and the stored memory data is displayed.
BLANK mode	: No updating of the trace memory is made, and the trace data are not displayed on the CRT but are stored in the memory.
Trace Arithmetic	
A-B → A	: Trace B amplitude is subtracted from trace A and the result is written into trace A from sweep to sweep.
A ⇄ B	: Exchanges traces A and B, changing their relative intensities and storage memory locations. Traces A' and B' are also exchanged.
B-DL → B	: Display line level is subtracted from trace B and the result is written into trace B.
NORMALIZE	: Comuputes A-B → A, A↔B, and B-DL → B at a time
CRT Display	
Screen size	: 100 mm x 124 mm (P31 phosphor)

(6) TRACKING GENERATOR

Frequency range : 400 kHz to 1800 MHz

Output level : 0 dBm to -50 dBm at 10 dB step

Output level accuracy: Within ± 1 dB at center frequency of 50 MHz

Spurious : 10 kHz to 50 kHz: Less than 5 dB

50 kHz to 1800 kHz: Less than 20 dB

Output connector : N female

Output impedance : 50 Ω, VSWR 1.5 or less (with ATT set at 10 dB or more)

Frequency response: 400 kHz to 1500 MHz: within ± 0.7dB

400 kHz to 1800 kHz: within ± 1.0dB

10 kHz to 1800 MHz: within ± 1.5dB

Other specifications are similar to those of the standard tracking oscillator.

Tracking drift : Less than 30 Hz/min, Less than 300 Hz/10 min

(Option 08)

Frequency range : 10 kHz to 1800 MHz

Other specifications are similar to those of option 02.

(7) PHASE MEASUREMENT

Frequency range : 400 kHz to 1800 MHz

Range : 80°, 40°, 20°, 8°, 4°, 2°, 0.8°, 0.4°, and 0.2° per division

Offset : Approx. $\pm 250^{\circ}$

Measurement range : $\pm 180^{\circ}$

Resolution : 1/10 or more of /div.

Accuracy : Better than $\pm 3\%$ ± 0.25 (after calibration)

Residual phase : Less than 100° p-p (with span set at 500 MHz or less, and input ATT. set at 10dB or more)

(8) GROUP DELAY MEASUREMENT

Frequency range : 400 kHz to 1800 MHz, 0 to 100 ms

Range : $16 \times \frac{1}{\text{frequency span}}$ to $\frac{1}{200} \times \frac{1}{\text{freq. span}}$ (sec/div.)

Measurement range : 160 ms/div. to 100 ps/div.

Resolution : $\frac{1}{50} \times \frac{1}{\text{frequency span}}$

Maximum resolution: 0.1 ns

Electrical length correction range: $8 \times \frac{3 \times 10^8}{\text{freq. span}}$ meters or more

Measurement accuracy: phase measurement accuracy $\pm$ span accuracy

(9) QP (quasi peak) detection mode

Display dynamic range		: 70 dB
1	Frequency range	: 10 kHz to 150 kHz
	Charging time constant	: 45 ms $\pm$20%
	Discharging time constant	: 500 ms $\pm$20%
	Display time constant	: 160 ms $\pm$20%
	Selectivity	: 200 Hz $\pm$20 Hz (at Bandwidth of 6 dB)
2	Frequency range	: 150 kHz to 300 MHz
	Charging time constant	: 1 ms $\pm$20%
	Discharging time constant	: 160 ms $\pm$20%
	Display time constant	: 160 ms $\pm$20%
	Selectivity	: 9 kHz $\pm$1 kHz (at Bandwidth of 6 dB)
3	Frequency range	: 30 MHz to 1000 MHz
	Charging time constant	: 1 ms $\pm$20%
	Discharging time constant	: 550 ms $\pm$20%
	Display time constant	: 100 ms $\pm$20%
	Selectivity	: 120 kHz $\pm$20 kHz (at Bandwidth of 6 dB)

(10) Impedance measurement option

The impedance measurement option is designed for use with the impedance measurement standard accessory.

Specifications of Mainframe Options

Functions:

Smith chart display	: Standard Smith chart Mangified (x10) Smith chart Polar coordinate display
Marker display:	Provides direct readouts for VSWR, reflection coefficient, phase, normalized impedance, and equivalent inductance or capacitance.
Display circle:	Displays an arbitrary circle representing a VSWR or reflection coefficient on the Smith chart.

Open/short auto correction	: When an open or shorting plug is attached, amplitude or phase can be calibrated to impedance 0 points and ∞ point on a Smith chart, (recommended when the frequency span setting is 500 MHz or below).

Specifications

Smith chart scale:

Standard Smith chart	: Real part: 0, 0.2, 0.5, 1, and 2
	Imaginary part: 0, $\pm$0.2, $\pm$0.5, $\pm$1, $\pm$2
Magnified Smith chart: Real part:	0.9, 1.0, 1.1, and 1.2
	Imaginary part: -0.1, 0, and 0.1

Polar coordinate scale:

Amplitude	: 20% divisions of the fullscale
Phase	: 30° division

Display resolution:

Amplitude	: 1/500 of the distance between the center of the Smith chart and its fullscale
Phase	: 1°
Frequency division	: 1/500 of the selected frequency span (variable to 1/16)

Marker point resolution:

Amplitude	: 1/500 of the distance between the center of the Smith chart and its fullscale
Phase	: 1°
Frequency division	: 1/500 of the selected frequency span

Marker readout resolution:

VSWR	: 3 digits
Reflection coefficient	: 3 digits
Phase	: 1°
Normalized impedance	: 3 digits
Equivalent inductance	: 3 digits

Polar coordinate display resolution	: 1/500 of the distance between the center and fullscale.
Polar coordinate display accuracy	: True value is within a circle with a radius of 1 mm and its center placed at the displayed value.
Display circle resolution	: 1/500 of the distance between the center and fullscale.
Amplitude information acquisition	: From mainframe basic mode (LIN x 1)
Phase information acquisition	: From mainframe basic mode 40°/div.

Amplitude setup on the Smith chart fullscale:

0.1 dB steps

Open/short auto correction range:

Amplitude correction range	: Between fullscale and 70% of fullscale
Phase correction range	: $\pm 180^{\circ}$

(11) Occupied bandwidth display

Trace data is divided into 1001 points to calculate power at each point. Two markers appear at the positions where 0.5% to the total power is determined from leftmost and from rightmost points respectively, and then frequency between two markers is displayed at the active function area on the left side of CRT.

(12) GENERAL SPECIFICATIONS

Operating temperature	: 0°C to $+40^{\circ}$C RH Less than 85%
Storage temperature	: -20°C to $+60^{\circ}$C
Power requirements	: 100, 120, 220 V ($\pm$10%), 240 V (+4%, -10%): 50/60 Hz approx. 300 VA
Probe power supply	: $\pm$15 V, 4-pin connector
Dimensions	: Approx. 424(W) x 311(H) x 550(D) mm
Weight	: Less than 50 kg

1-5. OPTIONS AND OPTIONAL ACCESSORIES

The following options and accessories are available for the TR4172 Spectrum Analyzer. Factory options should be ordered when ordering the analyzer.

1-5-1. Options

- X-Y recorder output (option 03: factory option)
  X output: 0 V to approx. +5 V
  Y output: 0 V to approx. +5 V
  Z output: 0 V to approx. +5 V
- Preamplifier (option 02 : factory option)
  Frequency range : 10 MHz to 1000 MHz
  Gain : 25 dB or more
  Flatness : Better than ±3 dB
- (Option 09)
  Frequency range : 10 kHz to 1000 MHz
  Gain : 20 dB or more
  Flatness : Better than ±3 dB
- Adjacent channel leakage power arithmetic operation software (option 06: factory option)
  Trace data is divided into 1001 points to calculate power at each point. The power equivalent to the width specified by the delta marker is calculated, and the ratio of the calculation result to the total power is displayed. In addition, the power equivalent to the width specified by the delta marker is integrated, and integration trace is also displayed.
- X-Y plotter interface (option 07: factory option)
  Trace data, graticule line, and character are plotted by following three plotters in papers of size 210 mm x 295 mm.
  [Applicable plotters]
  Model 9872A/7470A/7225A (Manufactured by Hewlett Packard)

1-5-2. Accessories

* Photographing system

(1) Camera (M75D) + close-up device (5R-32) + attachment (K-71R)

(2) Camera with hood (M085D) + attachment (#85-27)

*Standard impedance measurement accessories

(1) Directional bridge (60NF50)

(2) Standard cable (DGM010-00150EE): 2

(3) Open/shorting plugs for calibration (22N)

(4) Standard 50-ohm terminator (26N50)

* TR17301 shielding material tester

Measures the effects of metals, plastics, or other shielding materials upon electric and magnetic field waves over a broad frequency range from 1 MHz to 1000 MHz.

SECTION 2

PREPARATION AND GENERAL PRECAUTIONS

2-1. INTRODUCTION

This section describes the general handling procedure for the TR4172 Spectrum Analyzer-preparation, general precautions and storage method. To ensure proper operation of the analyzer read the following instructions carefully.

2-2. UNPACKING

After unpacking, carefully inspect the instrument for any transit damage, paying special attention to the panel switches, CRT display, and terminals.

If the instrument is damaged or fails to operate properly, immediately notify your nearest ADVANTEST representative.

2-3. REPACKING FOR SHIPMENT

Should it become necessary to repack the instrument for shipment, use the original packing material or equivalent.

2-4. OPERATING ENVIRONMENT

(1) The instrument should be placed in a position where it will not be exposed to direct sunlight, corrosive gas, or excessive dust. The operating ambience should be 0°C to +40°C in temperature, and not more than 85% in relative humidity.

(2) Ventilation

The instrument uses two exhaust cooling fans. Be sure to allow a space of more than 10 cm behind the instrument for adequate ventilation. Do not place the instrument on its side or back.

(3) Although the analyzer is protected from line noise interference, the local line noise environment should be considered. If excessive noise is expected, use a line noise filter in the primary circuit.

(4) The operation site should be free of excessive vibration.

(5) The storage temperature range is from $-20^{\circ}C$ to $+60^{\circ}C$.
If the instrument is to be left unused for a long period of time, cover it with a vinyl cloth or put it in a carton for storage in a dry place where it will not be exposed to direct sunlight.

2-5. CLEANING CRT DISPLAY

Clean the surface of the CRT screen and filter at regular intervals with a soft cloth dampened with alcohol.
Never use any chemical solvent other than alcohol for cleaning.
Remove the filter in the following procedure. (Refer to Figure 2 - 1.)

1. Remove the belt cover with a screwdiver.
2. Remove two screws from the CRT upper panel.
3. Remove two screws from the CRT bezel adapter.

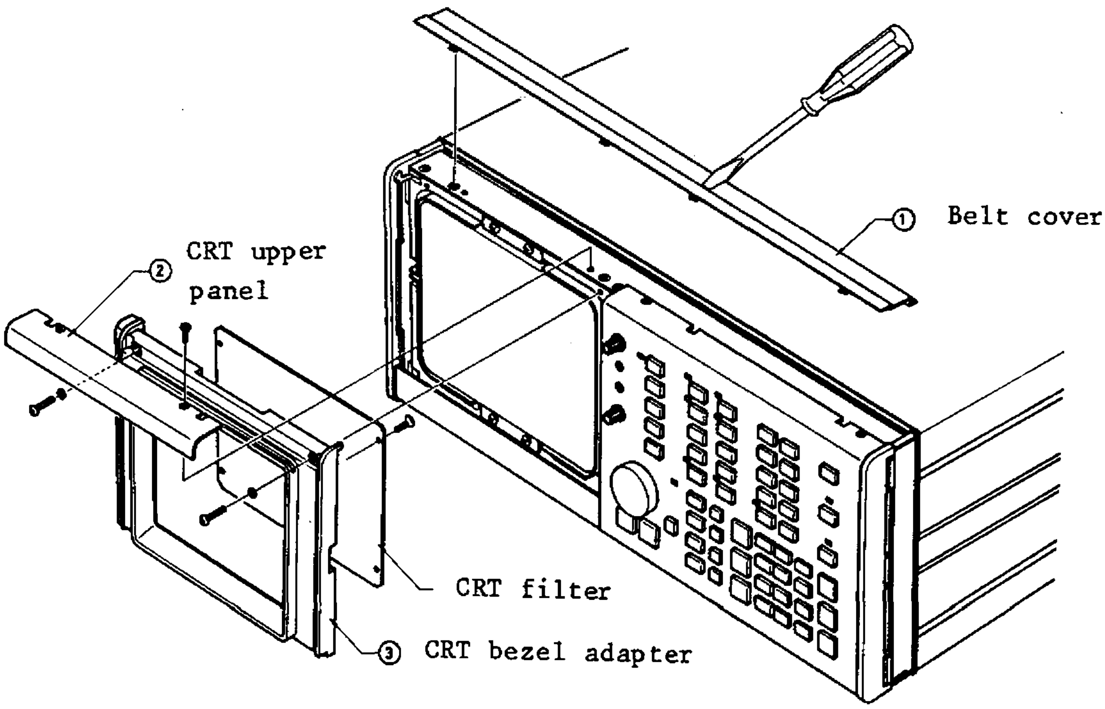


Fig. 2-1 Removal of CRT filter

2-6. PREPARATION

2-6-1. Connecting Display Section and RF Section

The analyzer consists of a display section and an RF section. Follow the procedure given below to assemble the two sections:

1. Mount the display section (with CRT) directly on the RF section.
2. Pull the display section forward until the joints engage with each other.
3. Push back the display section until the front surfaces of the two sections are aligned. Using a coin edge, fasten the two joint screws at the rear corners of the instrument.
4. Make electrical connections between the two sections with the three supplied interconnecting cables.

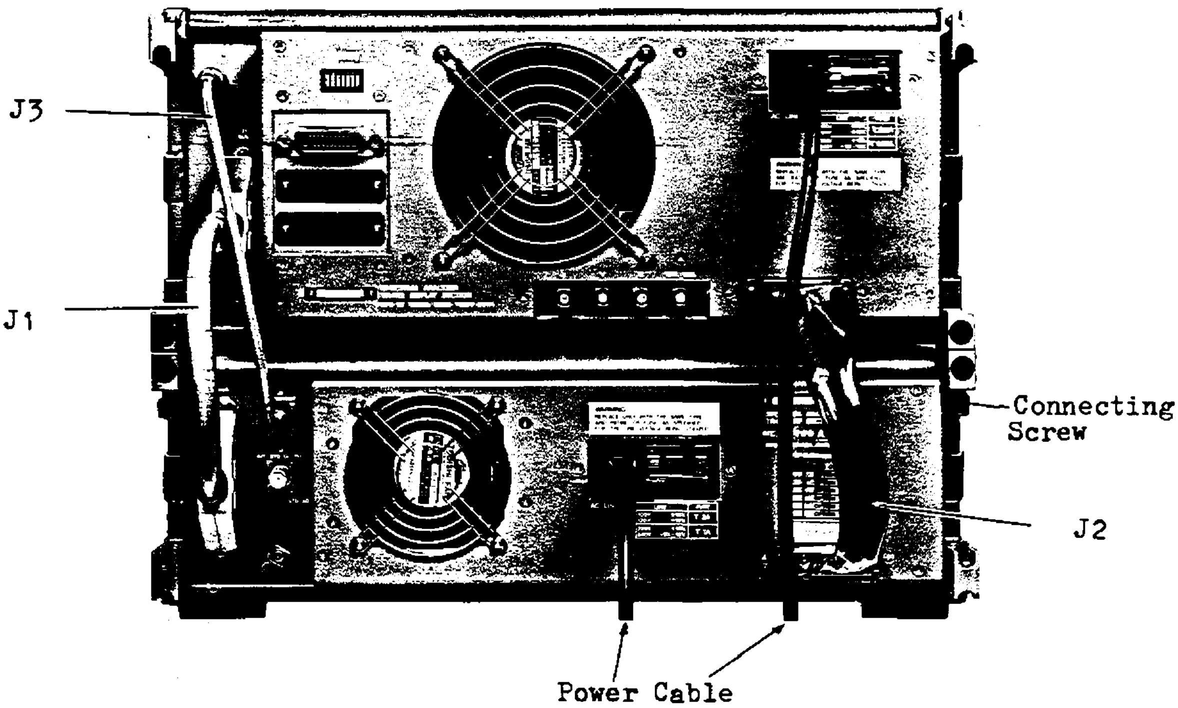


Fig. 2-2 Power and signal connections on the rear panels

5. Three signal connectors J1, J2, and J3 are provided on the rear panels of each section. Connect them with their own interconnecting cables (J1 to J1 and so forth).
6. Use the stopper and the connecting screw, when connecting J1 and J2 connectors, respectively.

2-6-2. Power Connection and Fuse

(1) Power cable connection

After establishing the signal connections between the two sections, make power connections to each section with the supplied power cables:

1. Make sure that the POWER switch on the RF section is in the STANDBY (out) position.
2. An AC LINE connector is provided on the rear panel of each section. Plug the female side of the supplied power cables into each of these AC LINE connectors. (See Figure 2-2.)

(2) Notes On Use of Power Cable

Before using TR4172 on commercial power, be sure to ground the equipment to prevent electric shock. Connect the concave end of the attached power cable (A01402) to the AC LINE connector. The power cable has a three-prong plug whose round prong is to be grounded.

When using a two-prong adapter to plug the power cable to a receptacle, connect the ground lead of the adapter to ground. The attached adaapter A09034 (KPR-18) conforms to the Electric Appliance Regulations. As shown in Figure 2-3, prongs A and B of A09034 are different in width, so make sure which is which when plugging this adapter into a receptable. Note that if the ground lead touches an AC line such as a power-supply terminal, the equipment may be damaged. Pay special attention when the ground lead comes close to other plugs.

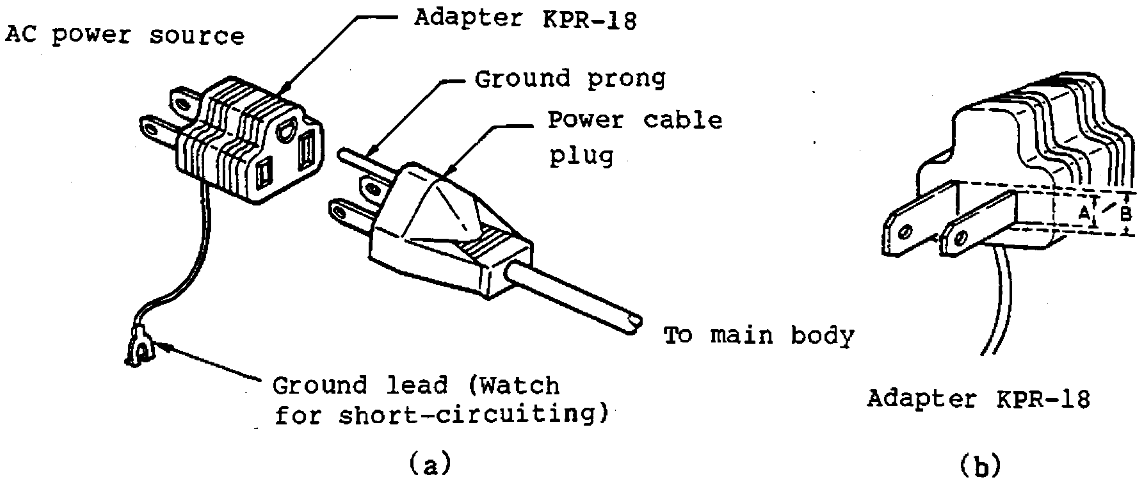


Figure 2-3 Power Cable plug and Adapter

When the instrument is plugged into an electrical outlet, the STANDBY indicator lamp on the front of the RF section will come on to indicate that the thermostatic oven for the internal master crystal oscillator is energized.

CAUTION

The instrument is partially energized even if the POWER switch is in the STANDBY position, as far as at least one of the power cables is connected to an electrical outlet. To completely turn off the instrument, be sure to disconnect both power cables from their electrical outlets.

(3) Fuse replacement

When replacing the fuse, unplug the power cable from the rear AC LINE connector of the pertinent section. Then, slide the clear plastic cover of the fuse box to the left stop. Pull the FUSE PULL lever forward to remove the fuse from the fuse box. The replacement fuse must follow the ratings of Table 2-1.

Line voltage setting can be changed by a voltage setting card inserted just below the fuse holder. When you have removed the fuse, you will see the voltage setting card just below the FUSE lever.

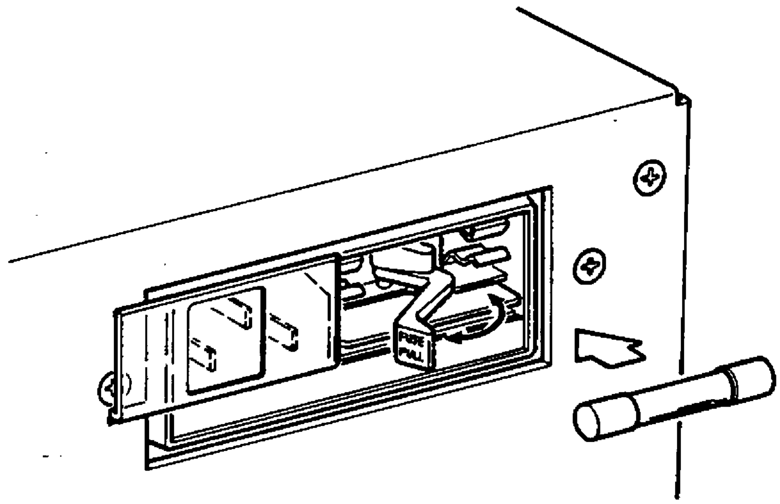


Fig. 2-4 Fuse replacement

Pull out the card and you will see voltage labels of 100 V, 120 V, 220 V, and 240 V on both sides of the card. Insert the card again into the card slot so that the voltage label corresponding to your local line voltage is on the top left side. You can see only the selected voltage label when the card is inserted in position.
The rating of the fuse to be used depends on the local line voltage. Check the fuse rating against the following table and replace it if needed:

Table 2-1 Fuse ratings versus line voltages

	Display section (upper)	RF section (lower)
AC100 V AC120 V	2.5 A slow blow	2.0 A slow blow
AC220 V AC240 V	1.25 A slow blow	1.0 A slow blow

2-7. USE OF PHOTOGRAPHIC EQUIPMENT

Assemble the close-up photographic equipment as illustrated in Figure 2-6. Photographic conditions differ depending on the setting of the INTENSITY control of the TR4172.

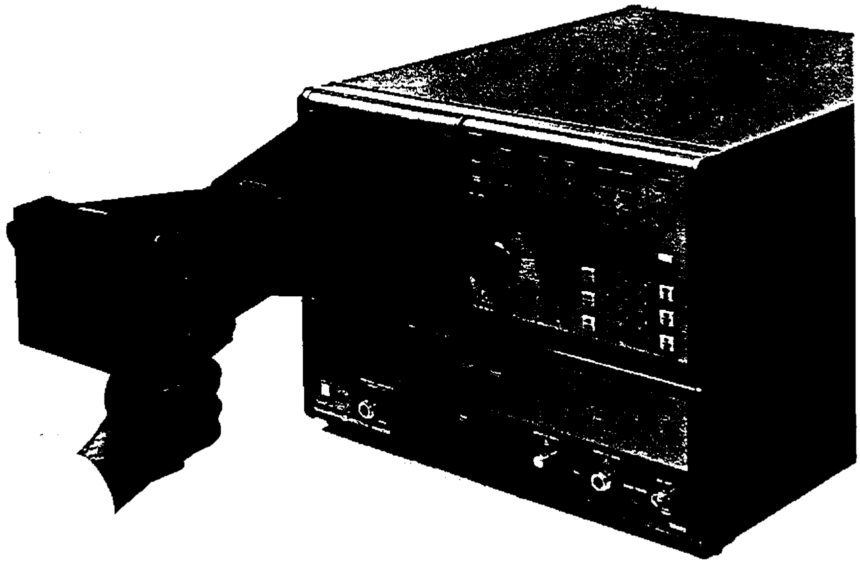


Fig. 2-5 Use of photographic equipment

Note: When the CRT display or the filter is not clear, clean photographs are not available. In this case, clean the screen and the filter referring to the subsection 2-5.

The film tends to get stuck if the roller inside the back plate becomes grimy. Take the roller out occasionally and clean it down.

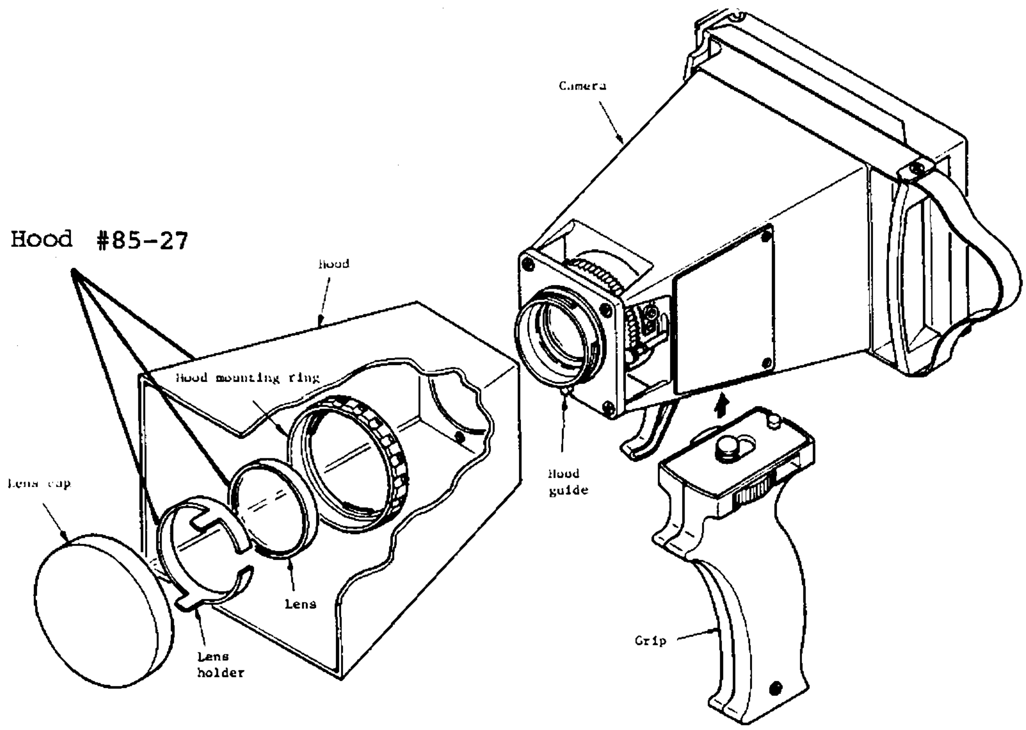


Fig. 2-6 Polaroid camera M-085D and Hood #85-27

MEMO

Section 3
PANEL DESCRIPTION

3-1. INTRODUCTION

This section first describes basic operating procedures for the TR4172 Spectrum Analyzer and then presents the functions and setting ranges of each switch and control. Each function will be discussed in detail in Section 4.

Operating details for the tracking generator, phase measurement, and group delay measurement are described in Section 5, 6, and 7 respectively.

3-2. OPERATING PROCEDURE

The analyzer's CRT display presents direct readout of the center frequency, reference level (level at the top graticule of the CRT), and so forth, as well as signal response trace and graticule display. The operation of the analyzer consists basically of setting various measurement functions with the front panel controls and key switches and observing the resulting signal response trace and data readouts on the CRT for analysis.

When the analyzer is initially switched on (POWER switch set to ON) or the MASTER RESET switch is pressed during operation, the measurement functions on the CRT display are initialized into the following state:

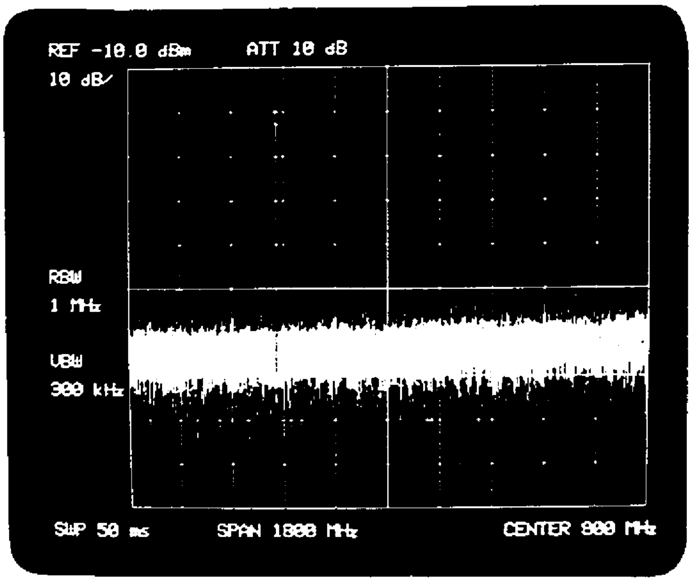
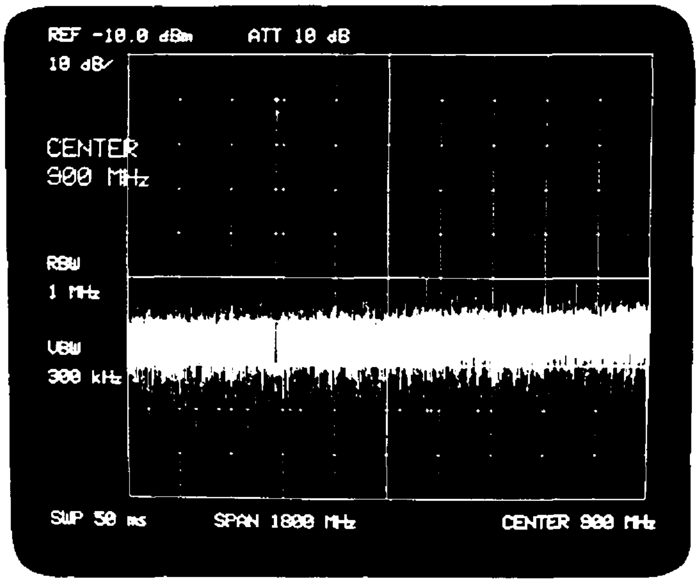


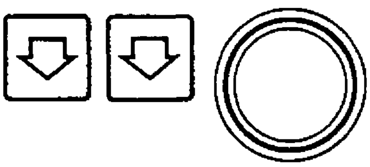
Fig. 3-1 Initial function setting upon power on or reset

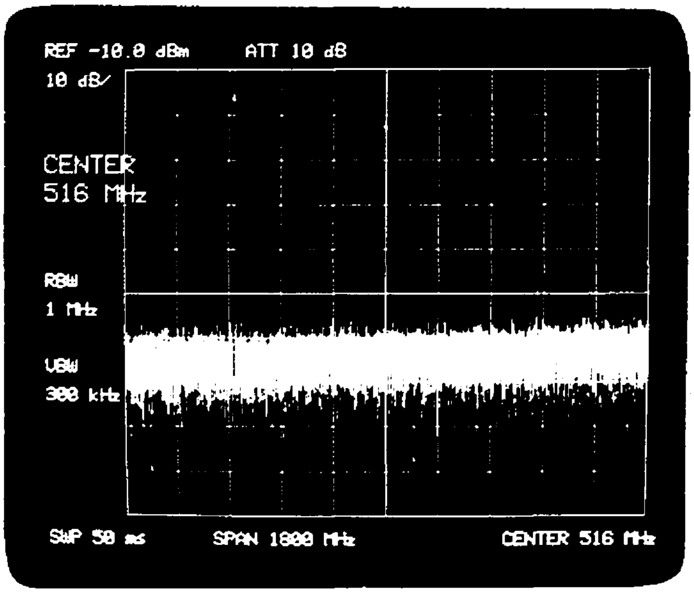
To change function settings, first press the pertinent function key and then adjust the Data knob until the desired setting is obtained. The Data step keys or Data number/units keyboard (Data keyboard) may be used instead of the Data knob.

For example, to move the object signal to the center of the display, first press CENT. FREQ. to activate the center frequency. The activated function is displayed to the left of the screen with enlarged readout. Since the center frequency readout is always provided at the bottom right corner of the display, there are now two identical center frequency readouts on the screen. The center frequency remains active until another function key is operated.

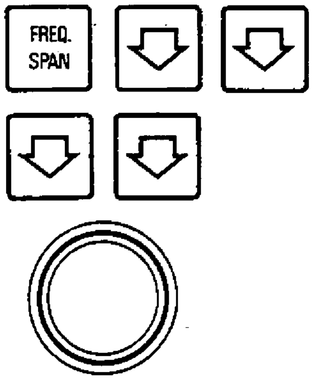


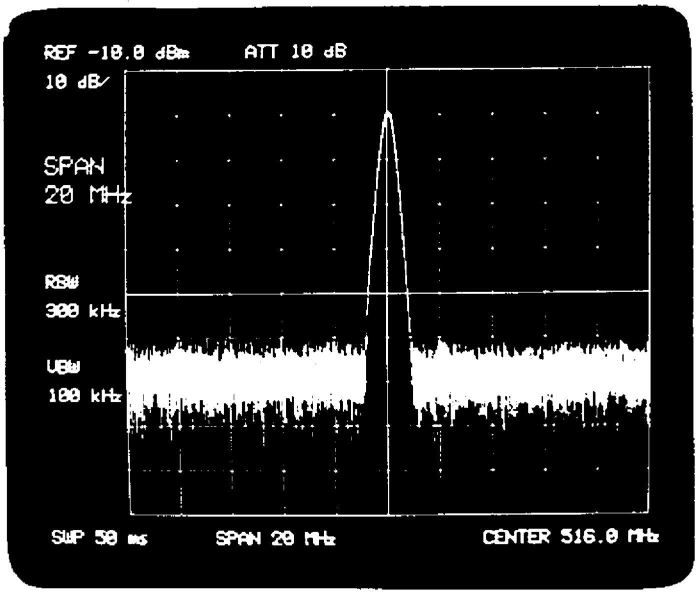
Use the Data knob to position the signal to the center of the display. For quicker control, first use the Data step keys to bring the signal to the near center, then make fine tuning with the Data knob. This practice may also be used for quick positioning of the marker (to be described later). The center frequency of the signal can now be read out.



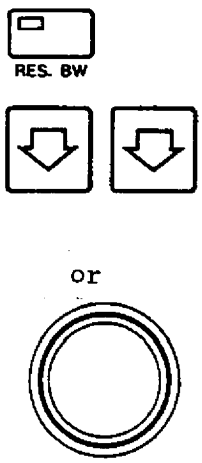


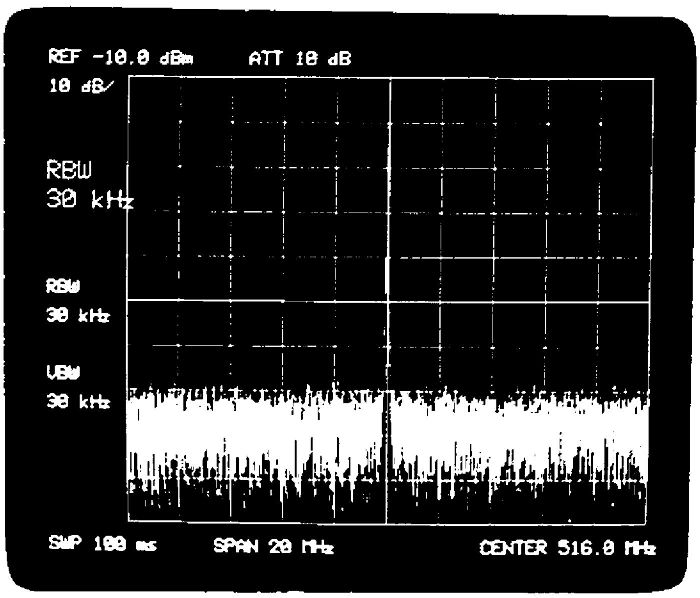
For better frequency resolution narrow the frequency span (frequency span from the left to right end of the display) with the FREQ. SPAN key and DATA control.



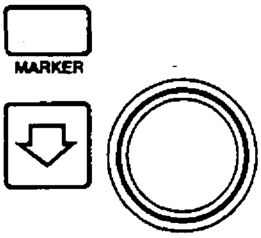


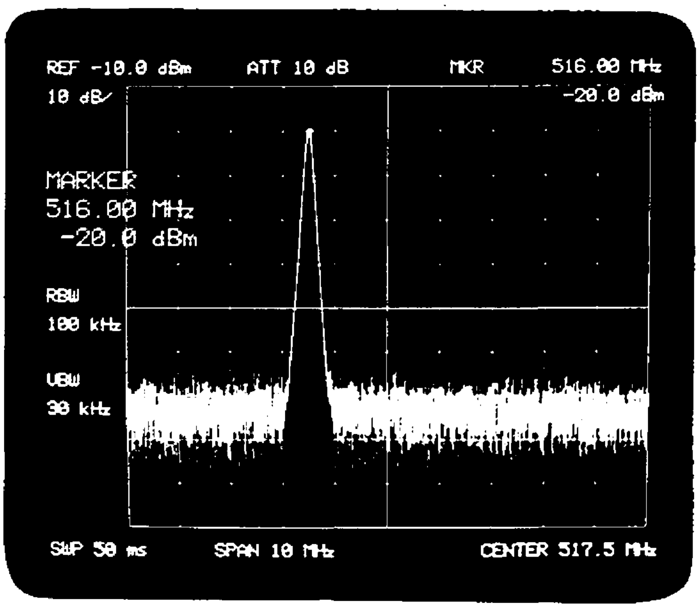
For higher signal resolution, the analyzer's IF bandwidth can be narrowed using the RES. BW. key and Data step key (down). Since the sweep time is normally set to AUTO, narrowed bandwidth causes lower sweep rate.





The signal frequency and level can be read out by using a marker (bright spot) without bringing the signal to the center of the display.
The MARKER key activates a single marker. The marker will move on the trace with the rotation of the Data knob. Tune the marker with the Data knob to position it to the signal peak. The signal's amplitude and frequency is read out directly. While the marker is on the display the amplitude and frequency at the marker are always read at the top right corner of the display.





3-3. PANEL DESCRIPTION

3-3-1. Front Panel Description (See Figure 3-2.)

(1) POWER switch

(2) STANDBY/ON indicator lamps

The STANDBY lamp comes on when the instrument is plugged into an electrical outlet with the POWER switch set at the STANDBY (out) position. The ON lamp comes on when the POWER switch is pressed into the ON position.

(3) MASTER RESET key

Resets the entire circuits of the analyzer into the condition shown on Table 4-2.

(4) LCL (Local) key

Returns the analyzer from remote operation mode (by an external GPIB controller) into local operation mode (by front panel keys of the instrument).

(5) RMT (Remote) indicator lamp

Goes on when the analyzer is in remote operation mode.

(6) T.G. (Tracking Generator) key

Activates the output of the integrated tracking generator.

(7) T.G. LEVEL key

Controls attenuation level for the tracking generator between 0 dB and 50 dB at 10 dB steps.

(8) TRACKING GENERATOR OUTPUT (50 Ω) connector

The output frequency range is from 400 kHz to 1800 MHz with an output impedance of 50 Ω.

(9) T.G. FREQ. ADJ. control

Corrects tracking error.

(10) GROUP DELAY key

Activates group delay measurement.

(11) PHASE key

Activates phase measurement.

(12) NORMAL key

Returns the instrument to the normal spectrum analyzer mode.

(13) INPUT-2 key

Selects INPUT-2: 10 MHz to 1000 MHz, max. -30 dBm, ±20 Vdc.
Operatable only when the optional preamplifier is built in.

(14) INPUT-2 connector

INPUT connector for the optional preamplifier.

(15) INPUT-1 DC key

Selects DC coupled INPUT-1: 50 Hz to 1800 MHz, max. +20 dBm, 0 Vdc

(16) INPUT-1 AC key

Selects AC coupled INPUT-1: 10 kHz to 1800 MHz, max. +20 dBm, ±25 Vdc

(17) CAL. screwdriver control

Used to adjust the calibration signal level (at INPUT-1) to -20 dBm.

(18) INPUT-1 connector

(19) INPUT ATT. key

Controls input attenuation level from 0 dB to 50 dB at 10 dB steps.

(20) AUTO key

Automatically sets input attenuation level from 10 dB to 50 dB at 10 dB steps.

(21) PROBE POWER connector

Four-pin connector to supply a power of ±15 V to an active probe.

(22) CAL. OUT. connector

Outputs a calibration signal of 50 MHz, -20 dBm ±0.3 dB.

(23) DATA knob

Continuously controls measurement function or marker position.

(24), (25) DATA step keys

Steps measurement function or marker position up or down.

(26) HOLD key

Inhibits function setting updating or entry from the DATA knob, DATA step keys, or data keyboard. Operation of any one of the FUNCTION keys clears the HOLD state.

(27) ENABLE indicator lamp

Goes on when data updating or entry is enabled. Goes off when the HOLD key is pressed.

(28) SWEEP TIME key

Sets sweep time between 20 ms and 1000 sec.

(29) AUTO (SWEEP TIME) switch

Automatically sets sweep time according to frequency span or RES. BW setting, etc.

(30) RES. BW (Resolution Bandwidth) key

Sets IF bandwidth between 10 Hz and 1 MHz at 1 to 3 sequence.

(31) AUTO (RES. BW) key

Automatically sets IF bandwidth according to frequency span.

(32) VIDEO BW key

Sets video filter's pass bandwidth between 1 Hz to 1 MHz at 1-3 sequence.

(33) AUTO (VIDEO BW) key

Automatically sets video bandwidth according to frequency span.

(34) CF STEP SIZE (Center Frequency Step Size) key

Determines center frequency stepping span by the DATA step keys.

(35) AUTO (CF STEP SIZE) key

Automatically sets the CF STEP SIZE to 1/10 of the frequency span.

(36) CENT. FREQ. (Center Frequency) key

Sets center frequency between 0 Hz and 1800 MHz.

(37) FREQ. SPAN (Frequency Span) key

Sets frequency span between 100 Hz and 2000 MHz.

(38) REF. LEVEL (Reference Level) key

Sets the reference level between -90 dBm and +50 dBm.

(39) DATA number/units keyboard

Used to enter measurement data or marker frequency directly with numerical data and units.

(40) BACK SPACE key

Backspaces data entry steps to permit correction of entry error.

(41) MHz dB sec/PHASE OFFSET key

One of the three unit keys. Data entry is completed by pressing a unit key after numerical data is keyed-in from the DATA keyboard. When phase measurement is active, pressing this key enables phase offset data entry.

(42) kHz +dBm msec/G.D. OFFSET key

One of the three unit keys. When the group delay function is active, pressing this key enables group delay offset data entry. Positive reference level data can be input with this key

after the reference level data is keyed-in from the DATA keyboard.

(43) Hz -dBm µsec key

One of the three unit keys. To enter negative reference level data, first key-in the positive level data from the DATA keyboard, then press this key.

(44) INTENSITY control

Controls intensity of all CRT display.

(45) FOCUS

A screwdriver adjustment which focuses all CRT display.

(46) TRACE ALIGN

A screwdriver adjustment which tilts all CRT display.

(47) SWEEP IND. (Sweep Indicator) lamp

Goes on during sweep.

(48) INT. (Internal) key

Automatically repeats internally-triggered sweep.

(49) LINE key

Triggers sweep start synchronously with the line frequency.

(50) EXT. (External) key

Triggers sweep start by an external trigger signal (TTL level) applied to the rear EXT. TRIG connector. Trigger occurs at HIGH to LOW transition of the external trigger signal.

(51) VIDEO key

Triggers sweep start if a detected IF signal reaches to a level set by the TRIG. LEVEL control (52).

(52) TRIG. LEVEL (Trigger Level) control

Controls trigger level for a detected video signal. If sweep fails to start when the VIDEO key is pressed, adjust this control for the adequate trigger level.

(53) SINGLE key

Each depression of this key triggers a single sweep.

Note: More detailed operations of the TRACE keys (54) to (63) will be described in Section 4-10.

(54) WRITE A key

Updates and displays trace memory A for each sweep.

(55) WRITE B key

Updates and displays trace memory B for each sweep.

(56) VIEW A key

Stops updating trace memory A and displays the latest signal response.

(57) VIEW B key

Stops updating trace memory B and displays the latest signal response.

(58) A ⇄ B key

Exchanges the contents of trace memories A and B.

(59) B-DL → B key

Display line level is subtracted from trace memory B contents and the result is written into trace memory B.

(60) A-B → A key

Trace B is subtracted from trace A for each sweep and the result is written into trace memory A.

(61) B → B' key

Writes trace memory B contents to trace memory B'.

(62) VIEW A' key

Displays the contents of trace memory A'

(63) VIEW B' key

Displays the contents of trace memory B'.

Note: More detailed operations of th MARKER keys (64) to (73) will be described in Section 4-9.

(64) MARKER key

Activates a single marker.

(65) MKR OFF key

Erases all markers from the display.

(66) Δ (delta) key

Activates two markers and provides a readout of frequency difference and level difference between the two markers.

(67) PEAK SEARCH key

Positions the marker to the highest signal peak.

(68) ZOOM key

Zooms in on a signal specified by a marker. Press the ZOOM key, identify the signal to be zoomed in on with the marker, then operate the Data step key (down) to narrow the frequency span.

(69) MKR → CF key

Substitutes the center frequency with a marker frequency to position the marker to the center of the display.

(70) SIGNAL TRACK key

Positions a drifting signal always at the center of the display.

(71) MKR/Δ → STEP SIZE key

Substitutes the center frequency step size with a marker frequency. In the Delta (Δ) mode the center frequency step size is given by the frequency difference between two markers.

(72) FREQ. CNTR key

Directly counts input signal frequency.

(73) MKR → REF. key

Substitutes the reference level with a marker level to position the marker on the top graticule of the display.

(74) DISPLAY LINE key

Activates a display line (horizontal cursor line).

Note: More detailed operations of the DISPLAY LINE key (74) will be described in Section 4-12.

(75) LABEL key

Permits entry of any alphanumeric characters in the top display area of the CRT screen. The entry procedure will be described in Section 4-12.

(76) SHIFT key

When pressed a first time, the analyzer enters the Shift Key mode and the functions indicated just above each key in yellow letters are made available. The Shift Key mode is cleared when any of the keys is pressed or the SHIFT key is pressed a second time.

Each key function in the Shift Key mode will be described in Section 4.

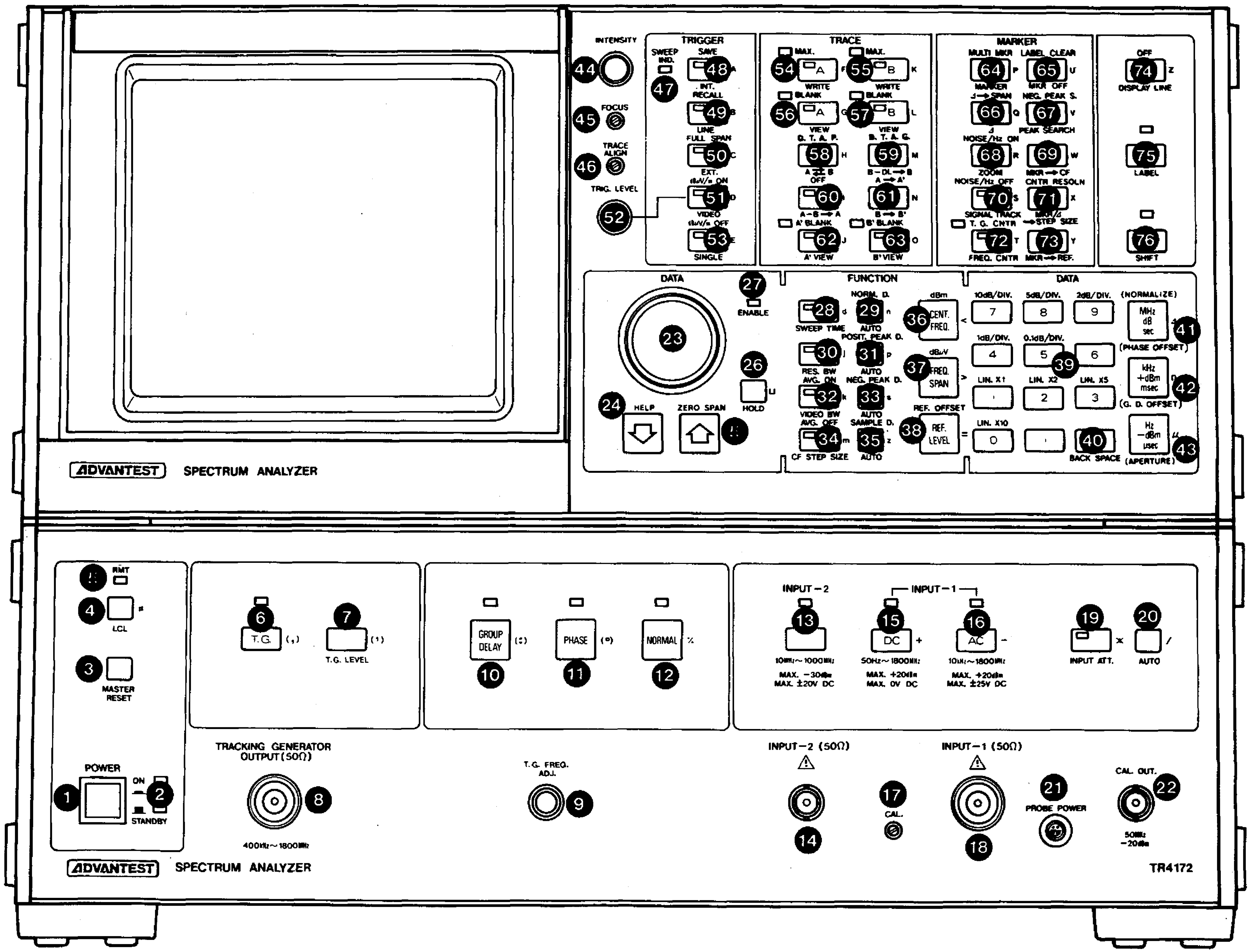


Fig. 3-2 Front panel

3-3-2. Rear Panel Description (See Figure 3-3.)

(1) J3 IF INPUT

Accepts signal from RF section J3 IF OUTPUT (11) via the supplied cable.

(2) J1 BUS connector

Connects to the RF section J1 BUS connector (10) via the supplied BUS cable.

(3) Ground terminal

When a two-conductor plug adapter is used for power connection, the ground lead of the adapter or this ground terminal should be connected to the earth ground.

(4) ADDRESS switch array

Used to designate the device address (1 to 5) of the instrument for remote operation.

(5) GPIB connector

Accepts a GPIB cable from an external controller or X-Y plotter.

(6) EXT. TRIG connector

Accepts an external trigger signal. When the front TRIGGER function is set to EXT. mode, the analyzer is triggered by the negative leading edge of an external TTL trigger signal.

(7) XYZ outputs

Optional X, Y, and Z axis outputs.

(8) J2 connector

Connects to the RF section J2 connector (15) via the supplied cable.

(9) AC LINE connector

Accepts a power cable.

(10) J1 BUS connector

Connects to the display section J1 BUS connector (2) via the supplied cable.

(11) J3 IF OUTPUT

Connects to the display section J3 IF INPUT connector (1) via the supplied cable.

(12) J4 INT. STD OUTPUT connector

A 10 MHz internal master oscillator output (TTL compatible). This output should be adjusted to exactly 10 MHz with screwdriver adjustment STD ADJ. (13). (See Section 4-26.)

(13) STD ADJ. volume

A screwdriver adjustment which adjusts the output frequency of J4 INT. STD OUTPUT connector (12) to exactly 10 MHz.

(14) Ground terminal

When a two-conductor plug adapter is used for power connection, the ground lead of the adapter or this ground terminal should be connected to the earth ground.

(15) J2 connetor

Connects to the display section J2 connector (8) with the supplied cable.

(16) AC LINE connector

Accepts a power cable.

(17) SWEEP OUT connector

Sweep voltage of 0 to +8 V is output from this connector.

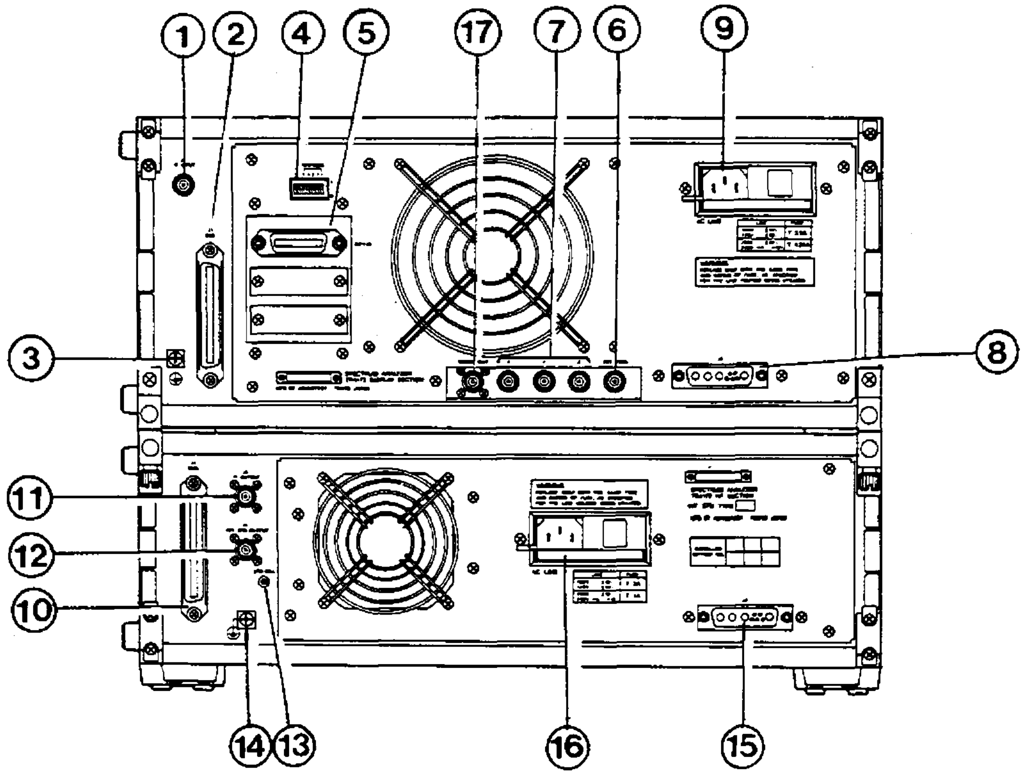


Fig. 3-3 Rear panel

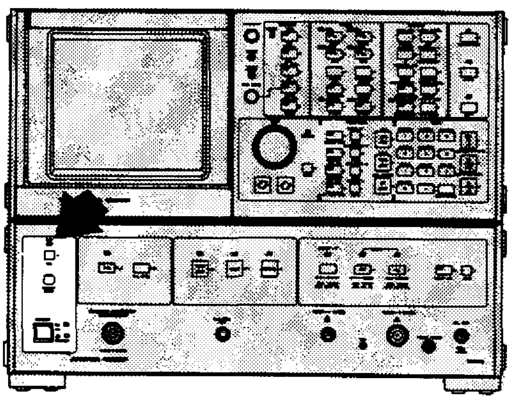
SECTION 4

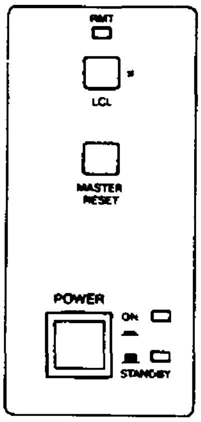
OPERATION

4-1. INTRODUCTION

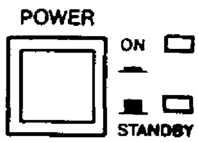
This section describes the versatile measuring functions of the TR4172 Spectrum Analyzer in more detail.

4-2. POWER, MASTER RESET, AND LCL KEYS





4-2-1. POWER Switch



Make signal and power connections for the instrument as indicated in Figure 2-2. When a two-conductor plug adapter is used for the power connection, be sure to connect the ground lead of the adapter of the rear ground terminal of the instrument to the earth ground.

Table 4-1 POWER switch setting

Power cables unplugged	Instrument completely turned off
Power cables plugged in STANDBY	Master crystal oscillator and back-up battery are turned on.
ON	Instrument completely turned on

When the instrument is plugged into electrical outlets, the STANDBY indicator lamp lights to indicate that the internal master crystal oscillator, and back-up Ni-Cd battery are turned on. When the POWER push switch is pressed into the ON position, the ON indicator lamp lights to indicate that the instrument is completely turned on.
To use the analyzer within its accuracy specifications, approximately 24 hours of warm-up time is required under the STANDBY or ON state.
The internal memory contents remain intact for approximately two weeks even if the instrument is unplugged from its supply outlets, provided the back-up battery is fully charged beforehand. The Ni-Cd battery will require a charging time of two to three days.
Unless the instrument is to be left unused for a prolonged period of time, it is recommended that the analyzer be left in the STANDBY state with its power cables plugged into their supply outlets.

4-2-2. MASTER RESET

When pressed, the MASTER RESET key clears the analyzer's functions to the initial state. The functions affected by the MASTER RESET key and their initial states are listed below.
The MASTER RESET key may be used if the analyzer is malfunctioning due to noise interference or other causes.

Initial States of Functions Affected by the MASTER RESET

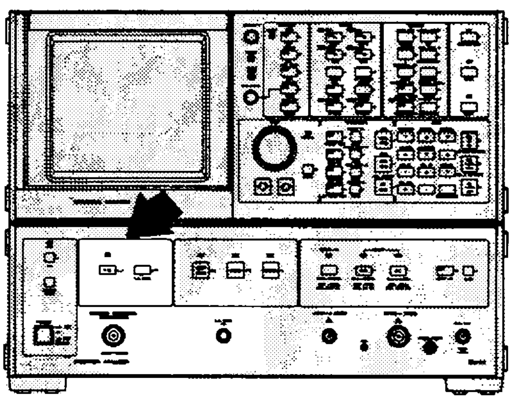
CENT. FREQ.	900 MHz
FREQ. SPAN	1800 MHz
Reference level	-10 dBm
SWEEP TIME	AUTO (50ms)
RES. BW	AUTO (1 MHz)
VIDEO BW	AUTO (300 kHz)
CF STEP SIZE	AUTO
INPUT ATT.	AUTO (10 dB)
INPUT MODE	AC
NORMAL	ON
PHASE	OFF
GROUP DELAY	OFF
T. G.	OFF
TRIGGER	INT.

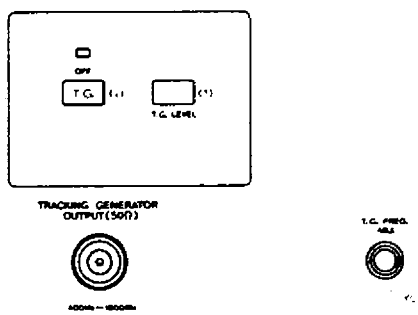
TRACE	WRITE A
	BLANK A'
	BLANK B
	BLANK B'
	Other keys OFF
MARKER	All OFF
DISPLAY LINE	OFF
LABEL	OFF
SHIFT	OFF
INT. STD OUT	OFF
dB/DIV.	10 dB/DIV.

4-2-3. LCL

The LCL (Local) key is operative when the analyzer is in remote operation mode.
When the analyzer is remotely controlled by an external GPIB controller, the RMT indicator lamp just above the LCL key lights to indicate that front panel control of the analyzer is prevented except for the MASTER RESET key operation.
When the LCL key is pressed, the RMT lamp will go off to indicate that front panel control of the analyzer is enabled. If the Local Lockout command is sent from the GPIB controller, however, the LCL key remains inoperative.

4-3. T.G., T.G. LEVEL, AND T.G. FREQ. ADJ.





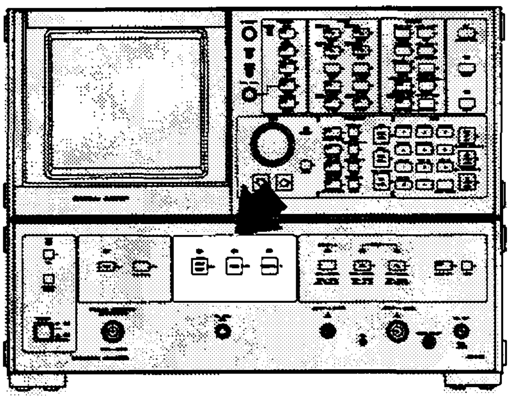
These keys are for internal tracking generator control. Press [T.G.] to activate the tracking generator; the indicator lamp just above the TG key lights.

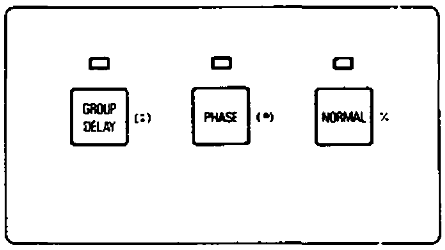
Press [SHIFT] [T.G.] (OFF) to deactivate the tracking generator; the indicator lamp goes off.

The tracking generator is used for phase or group-delay measurements as well. More detailed operations of the tracking generator, including the T.G. LEVEL and T.G. FREQ. ADJ. controls, will be described in Section 5. For normal operations of the analyzer, leave the tracking generator inactive. This will enable measurement capability at the maximum sensitivity of the instrument. When the tracking generator is activated, the analyzer's sensitivity may be degraded due to noise interference from the tracking generator.

The tracking generator is also activated when the PHASE or GROUP DELAY key is pressed. If the normal measurement mode (for spectrum analysis) is restored with the NORMAL key, the tracking generator will remain active. To deactivate the tracking generator press SHIFT, T.G..

4-4. GROUP DELAY, PHASE, AND NORMAL KEYS





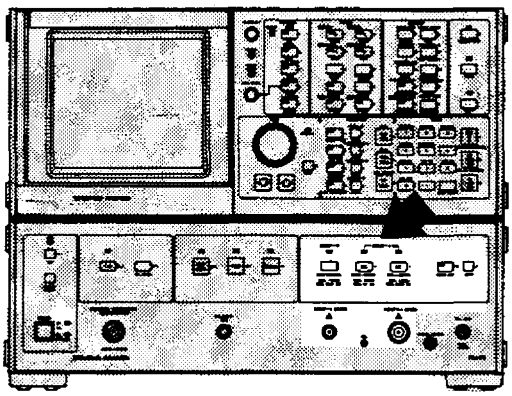
These keys select analyzer's mutually exclusive measurement modes. When one of [GROUP DELAY], [PHASE], and [NORMAL] is pressed the corresponding measurement mode is selected and the indicator lamp for the selected mode lights.

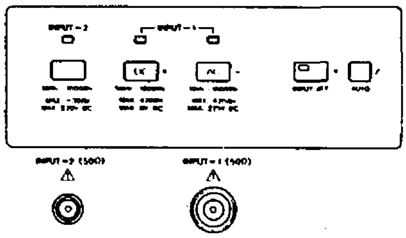
For details of phase measurement and group delay measurement see Section 6 and 7 respectively.

The analyzer should normally be placed in the Normal mode by pressing the NORMAL key.

Once the GROUP DELAY or PHASE measurement mode is entered by pressing the respective key, the internal tracking generator is activated and remains activated even after the analyzer is returned to the NORMAL measurement mode. When the tracking generator is unused, press SHIFT, T.G. to deactivate it.

4-5. INPUT





These keys are input controls and settings of RF attenuator.

4-5-1. INPUT-2

INPUT-2 is dedicated for the optional preamplifier. To select the preamplifier input press the INPUT-2 key; the indicator lamp just above the key will light to indicate that INPUT-2 is selected. When the preamplifier is not built-in, the lamp remains off even if pressed. The specifications for INPUT-2 are:

Frequency range: 10 MHz to 1000 MHz

Input impedance: 50 Ω

Maximum input level: -30 dBm, ±20 Vdc

4-5-2. INPUT-1 (DC, AC)

To select INPUT-1 press DC or AC.

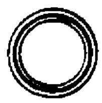
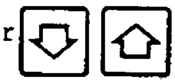
When DC is pressed, INPUT-1 is DC coupled to the 1st mixer to enable signal response observation over a frequency range from 50 Hz to 1800 MHz.

Never apply a DC voltage to INPUT-1 when DC mode is selected; otherwise the input circuit of th 1st mixer will be permanently damaged.

When AC is pressed INPUT-1 is AC coupled to the 1st mixer to permit signal response observation over a frequency range from 10 kHz to 1800 MHz. The maximum allowable input level is +20 dBm or ±25 Vdc. When the analyzer is turned on or the MASTER RESET key is pressed, the AC mode for INPUT-1 is automatically selected.

4-5-3. INPUT ATT. INPUT ATT. AUTO

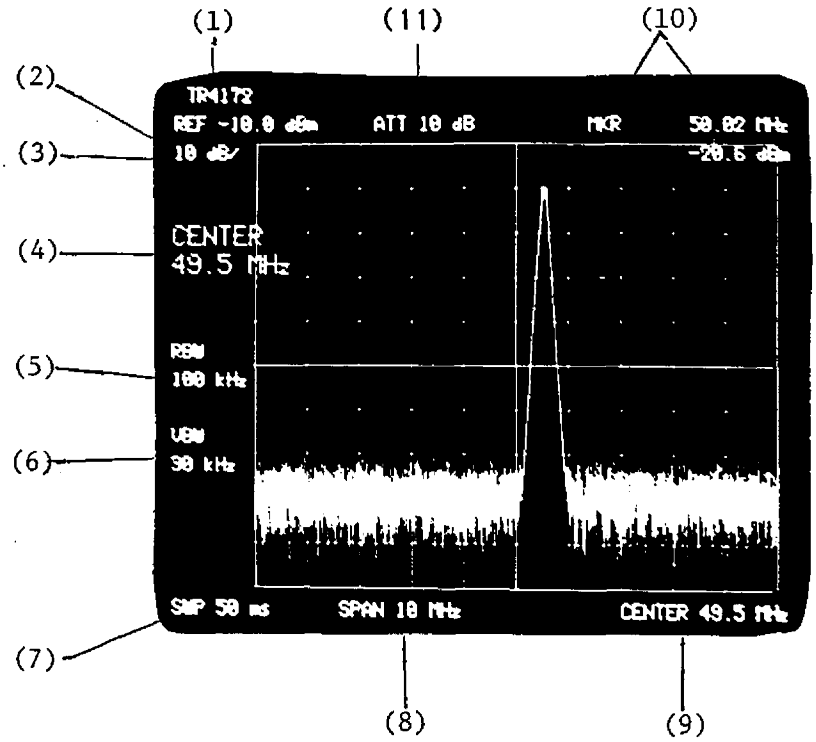
The INPUT ATT. key controls the input attenuator's attenuation level between 0 dB and 50 dB at 10 dB steps.
Normally, the input attenuator is controlled in the AUTO mode, in which the attenuation level is automatically set between 10 dB and 50 dB according to the REF. LEVEL key setting. To protect the input mixer, 0 dB attenuation is not selected when in the AUTO mode.
The currently selected attenuation level is always read at the top of the CRT display such as ATT XXdB.

When manual setting of the input attenuator is desired, press INPUT ATT.; the key indicator lamp will come on.
The attenuation level is now active and the current attenuation level "ATT XXdB" is read to the active function display area of th CRT display. Set attenuation to the desired level with  or  or  .

To return the attenuator to the AUTO control mode press AUTO. The key indicator lamp on INPUT ATT. will go off and the attenuator is automatically controlled according to the REF. LEVEL setting.

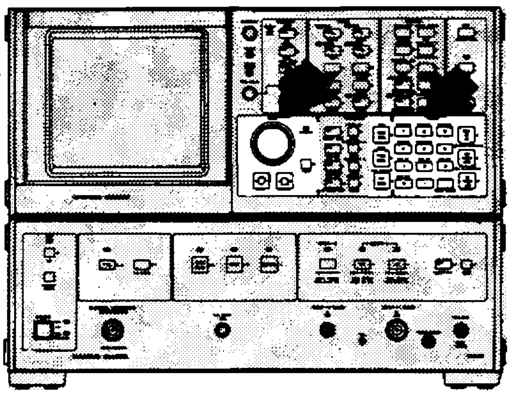
4-6. CRT DISPLAY

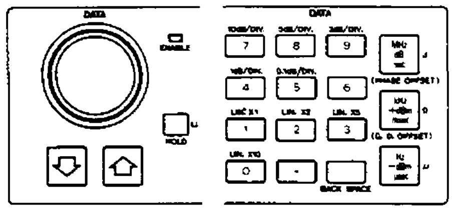
The CRT display presents the signal response trace, graticule, measurement data, and labels.



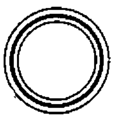
(1)	TR4172	Label which can be optionally written by the user (Section 4-12-2)
(2)	REF	Reference level (Section 4-8-3)
(3)	10 dB/	Vertical scale per division (Section 4-8-4)
(4)	(CENTER)	Active function (Section 4-8)
(5)	RBW	Resolution bandwidth (Section 4-8-6)
(6)	VBW	Video bandwidth (Section 4-8-7)
(7)	SWP	Sweep time (Section 4-8-5)
(8)	SPAN	Frequency span (Section 4-8-2)
(9)	CENTER	Center frequency (Section 4-8-1)
(10)	MKR	Marker (Section 4-9)
(11)	ATT	Input attenuator level (Section 4-5-3)

4-7. DATA



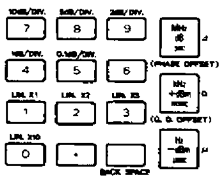


Any function can be selected by pressing the appropriate front panel function key, and changed by using any or all of the following DATA controls:



: DATA knob

: DATA step keys

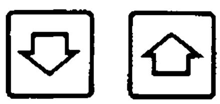


: DATA number/units keyboard (DATA keyboard)

4-7-1. DATA Knob

Continuously turning the DATA knob clockwise increases function data which is currently active. In the MARKER mode clockwise rotation of the DATA knob moves the marker to the right. In the DISPLAY LINE mode it moves the display line upwards. Turning the DATA knob counterclockwise decreases function data.

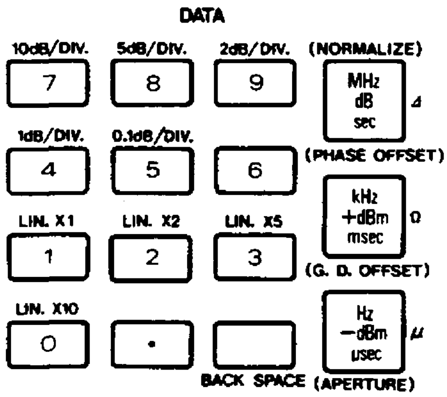
4-7-2. DATA Step Keys



The DATA step keys change function data in predetermined steps each time they are pressed. In the MARKER mode each operation of the step keys moves a marker one division on the horizontal axis of the CRT display.

Step size can be changed by using the MKR/Δ →STEP SIZE or CF STEP SIZE key.
More detailed operations of these keys will be described in the sections "4-8 FUNCTION" and "4-9 MARKER".

4-7-3. DATA Keyboard



The DATA keyboard permits direct entry of numerical data.
Function data can be entered by pressing a unit key after operating data number keys. If you have missed entry of number data, press the BACK SPACE key and then retry correct data entry.

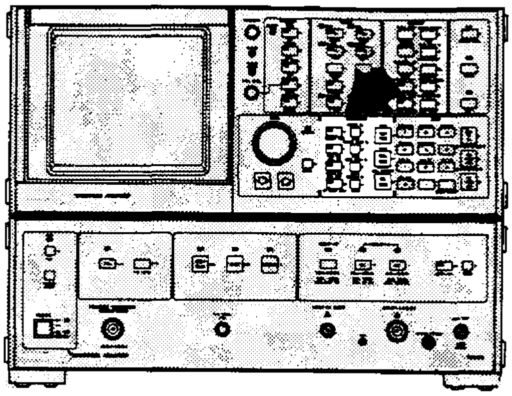
4-7-4. HOLD

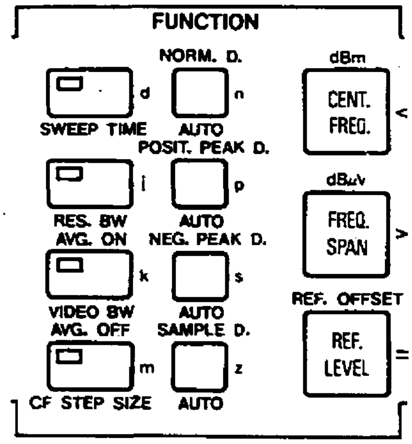
ENABLE

HOLD

Data change or entry using the DATA knob, DATA step keys or DATA keyboard is inhibited by pressing the HOLD key. (The ENABLE indicator lamp just above the HOLD key goes off.)
The HOLD state is cleared by operating a key other than the DATA controls or keys; the ENABLE indicator lamp goes on to indicate that data change or entry is enabled.

4-8. FUNCTION





When the analyzer is initially switched on, center frequency, frequency span, reference level, etc. are automatically set to the initial values shown on Section 4-2-2. These values can be changed by using the FUNCTION keys and DATA controls.

Sweep time, manual setting of bandwidth (normally automatically set), or vertical scale can also be controlled with the FUNCTION keys and DATA controls. To specify function data first press the appropriate function key.

The activated function is shown on the left side of the CRT display.

The data can be changed with the DATA knob, DATA step keys or DATA keyboard. The function remains active until another FUNCTION key or the MARKER key is operated.

The functions of the individual FUNCTION keys are described below.

4-8-1. CENT. FREQ.

This key is used to activate center frequency, which can be set over a range from 0 Hz to 1800 MHz. The maximum number of digits (resolution) of center frequency setting depends on the selected frequency span.

The DATA knob allows fine control of center frequency. The DATA step keys enables frequency shift in steps (normally 1/10 of the selected frequency span). The DATA keyboard enables direct entry of numerical center-frequency data. Using the DATA keyboard, the actual data entry occurs when one of the units keys, MHz, kHz or Hz, is pressed after numerical data is entered.

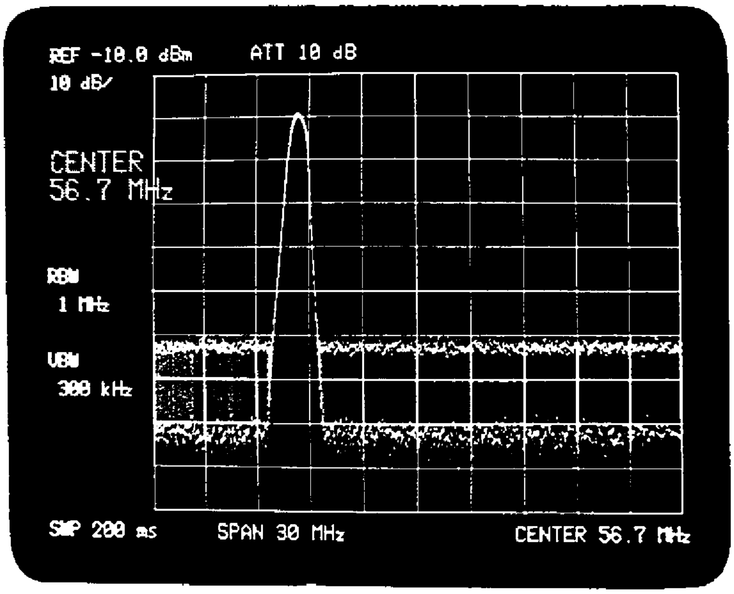
center frequency is always shown at the bottom right corner of the display (except in Log Display mode).

4-8-2. FREQ. SPAN

FREQ. SPAN

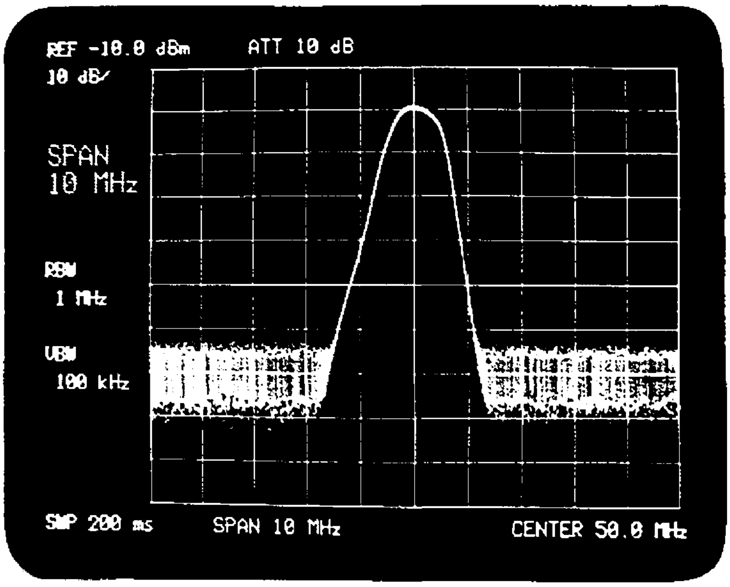
This key is used to activate the frequency span.
Frequency apan across the axis can be set over a range from 100 Hz to 2000 MHz; that across one division of the graticule is 1/10 of the frequency span.
The frequency span can be changed with the DATA knob or DATA step keys and DATA keyboard. The DATA keyboard enables direct entry of numerical frequency-span data.
The display always presents frequency span data at the bottom of the screen (except in Log. Display mode). When the RBW and VBW functions are set in AUTO mode, resolution bandwidth and video bandwidth are automatically set to the optimum according to the selected frequency span.

Example of CENT. FREQ. and FREQ. SPAN usage:

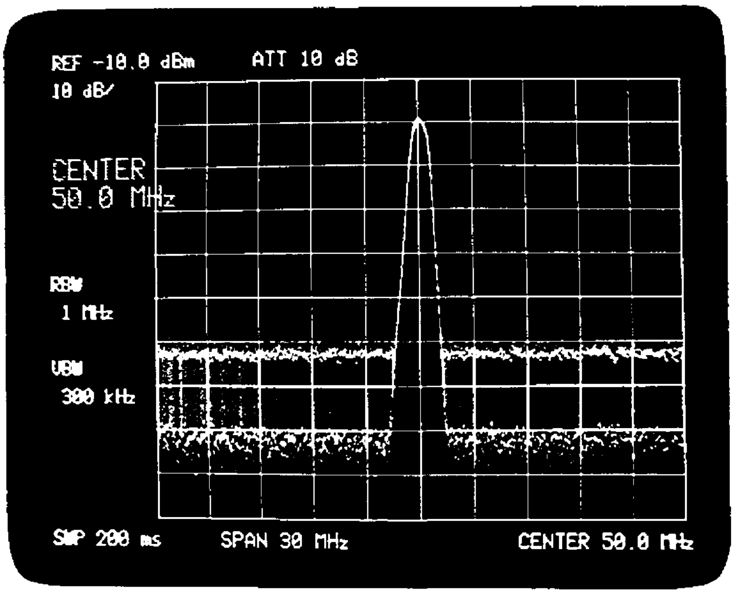


The signal to be measured is to the left of center of the display. Reduce the center frequency with CENT. FREQ. ⇩ ⇩ to shift the signal to the right.

Then tune the signal to the exact center of the display with .



For better frequency resolution narrow the frequency span with FREQ. SPAN ⇩ ⇩ .



If the signal deviates from the center of the CRT when the frequency span is narrowed, reposition the signal to the center with the CENT. FREQ. key and DATA knob.

Zero Frequency Span:

When SHIFT, ZERO SPAN are pressed, the horizontal display axis becomes calibrated in time and the spectrum analyzer is fixed tuned to the center frequency. As a result, the analyzer operates as a receiver fixed tuned to the center frequency.

Press SHIFT, ZERO SPAN again to restore the normal spectrum analyzer function with the horizontal display axis calibrated for frequency.

4-8-3. REF. LEVEL

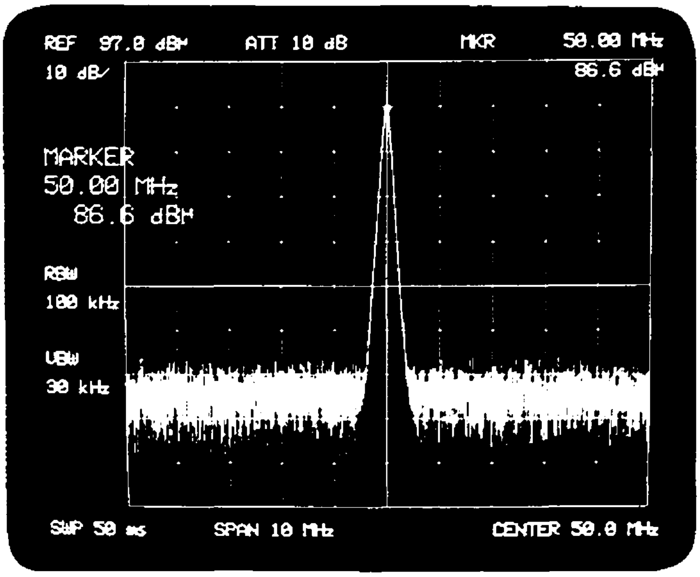
REF. LEVEL

This key is used to activate the reference level at the top graticule of the CRT display. The reference level can be specified over a range from -90 dBm to +50 dBm in 0.1 dB steps. The DATA step keys control the reference level in 10 dB steps, while the DATA knob can control it in 0.1 dB steps.

The DATA keyboard enables direct entry of reference level values. For entry of a positive value press kHz +dBm msec, and for entry of a negative value press Hz −dBm μsec after keying in the numerical data.

The specifiable range of the reference level may be reduced to smaller than -90 dBm to +50 dBm depending on the input attenuator setting. Reference level can be specified in dBμ with SHIFT, dBm CENT. FREQ. . Pressing SHIFT, dBμV FREQ. SPAN returns the reference level readout to dBm.

SHIFT, dBm CENT. FREQ.



4-8-4. Vertical Scale Control

The scaling of the vertical graticule divisions of the CRT display is normally set in 10 dB/div.
Look at the top left corner of the display in the following figure. "REF -20.7 dBm" shows that the reference level is presently read in dBm, and "10 dB/" indicates that the scaling of the vertical graticule division is 10 dB/div. A unit of dBμ is also selectable (see paragraph 4-8-3). Scaling can also be selected from 5, 2, 1, and 0.1 dB per division, and linear scaling.

For 5 dB/div. press [SHIFT] [8] (5dB/DIV.).

For 2 dB/div. press [SHIFT] [9] (2dB/DIV.).

For 1 dB/div. press [SHIFT] [4] (1dB/DIV.).

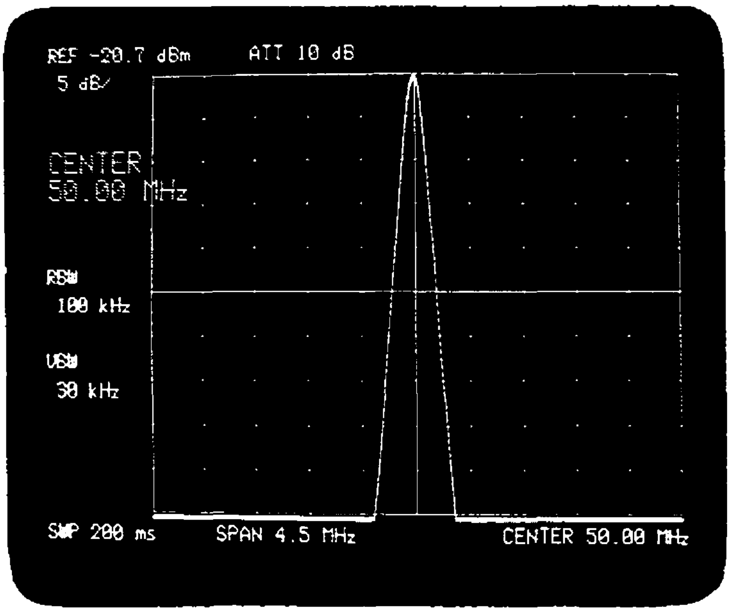
For 0.1 dB/div. press [SHIFT] [5] (0.1dB/DIV.).

For 0.5 dB/div. press [SHIFT] [5] [1] .

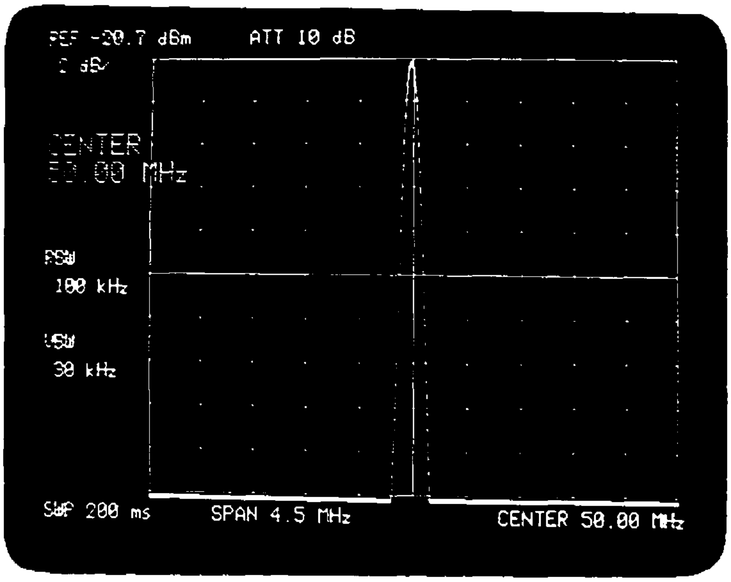
For 0.2 dB/div. press [SHIFT] [5] [2] .

In the 0.1 dB/div., 0.2 dB/div., 0.5 dB/div., the effective range of the vertical scale is down to 8 divisions below the reference level, with display linearity not guaranteed in the bottom two divisions.

[SHIFT] [8] (5dB/DIV.)



2dB/DIV.
[SHIFT] [9]



The scale can be set up for linear units to read amplitudes proportional to input signal power.

If [SHIFT] [1] (LIN. X1) are pressed linear scale x1 is selected, with the top and bottom graticules assigned to the reference and 0 V levels, respectively.

The scale can be changed in allowable increments of x2, x5, and x10 with [SHIFT] [2] (LIN. X2), [SHIFT] [3] (LIN. X5), and [SHIFT] [0] (LIN. X10), respectively. In this case the reference level does not change.

4-8-5. SWEEP TIME [SWEEP TIME] [AUTO]

This key is used to activate sweep time within a range from 20 ms to 1000 sec. When the analyzer is initially switched on, sweep time control is set in AUTO mode, in which it is automatically set according to frequency span, resolution bandwidth or video bandwidth to minimize level error.

[SWEEP TIME] clears the AUTO mode to permit manual setting of sweep time (indicator on the key goes on) with the DATA knob, DATA step keys, or DATA keyboard.

[AUTO] again selects the AUTO mode for sweep time control; the indicator on the [SWEEP TIME] key goes off.

If sweep time is set too long in the AUTO mode, it can be temporarily reduced with [SWEEP TIME] [⇩] [⇩] [⇩] for quick observation of signal response. In this case, if the error of level reading exceeds 0.5 dB, message "UNCAL" will be shown.
Once the outline of the signal response is checked, restore the AUTO mode so the UNCAL message is cleared.
In Zero Frequency Span mode, sweep time can be set between 100 μs and 1000 sec.

4-8-6. RES. BW [RES. BW] [AUTO]

This key is used to activate resolution bandwitth (IF bandwidth).

AUTO automatically sets resolution bandwidth according to the selected frequency span.

[RES. BW] permits manual setting of resolution bandwidth with DATA controls. A signal response can be separated from its adjacent noise response or two or more signal responses can be separated from each other, by narrowing the resolution bandwidth. The DATA key ([⇩]) may be conveniently used to narrow the resolution bandwidth.

When sweep time control is in AUTO mode, sweep time is increased as resolution bandwidth is narrowed.

4-8-7. VIDEO BW [VIDEO BW] [AUTO]

This key is used to activate video bandwidth within 1 Hz to 1 MHz in 1 or 3 sequence.
AUTO automatically sets video bandwidth to the optimum according to the selected frequency span.
Signal responses near the noise level of the analyser will be visually masked by the noise. The video filter can be narrowed to smooth this noise, although a longer sweep time will be required when the video bandwidth is narrowed.

With the video averaging feature, which digitally averages the signal responses for each sweep, a better signal-to-noise ratio can be expected with a shorter sweep time. For more details see Section 4-14-1. Averaging.

4-8-8. CF STEP SIZE

CF STEP SIZE m AUTO z

This key is used to activate the center frequency step size for center frequency control using ⇩ ⇧.

AUTO automatically sets the step size to one tenth the frequency span. Surveillance of a wide frequency span sometimes requires high resolution. One fast way to achieve this is to take the span in sequential pieces using a tailored center frequency step. This technique is described below:

Set the center frequency and frequency span for the lowest frequency range of the signal response to be measured.

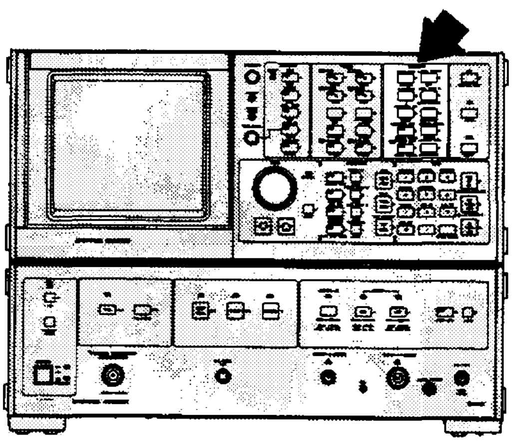
Press CF STEP SIZE and then use the DATA keyboard to enter the same value as the frequency span. Activate the center frequency with CENT. FREQ..

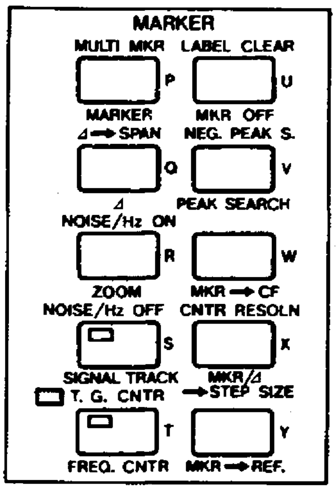
Now each ⇧ sets the center frequency to the next span.

Center frequency step size can also be specified with MKR/Δ →STEP SIZE.

For more details see Section 4-9. MARKER.

4-9. MARKER





Use of the MARKER controls increases the speed and accuracy of many measurements. The Multi Marker mode presents up to 10 markers available on the display.

4-9-1. MARKER

MARKER

MARKER activates a single marker at the center of the display or at the last marker spot.

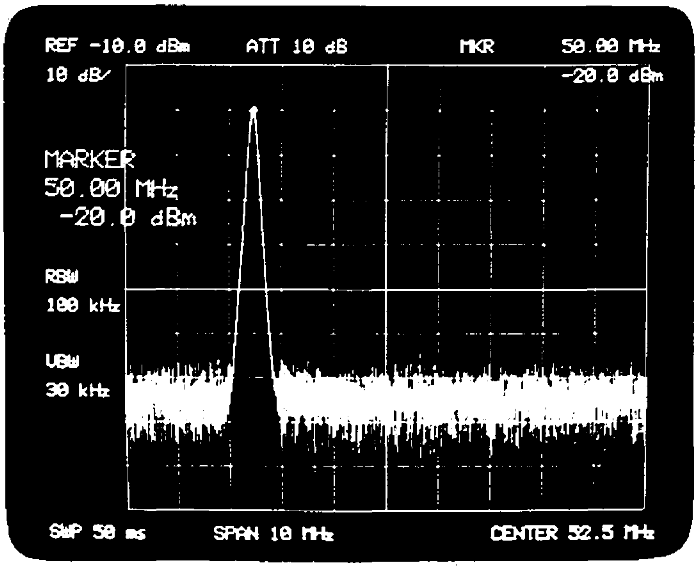
The frequency and amplitude at the marker will be shown on the active function display area. The same data readouts are presented at the top right corner of the display as well. While the MARKER is normally abbreviated as "MKR" for readout, it is read as "COUNTER" or "CNTR" in the FREQ. CNTR mode or T.G. CNTR mode (to be described later).

An active marker can be moved on a signal response trace with the DATA controls. The DATA knob can continuously control marker position for fine tuning. The DATA step keys move the marker in steps of one division each for faster control.

Use of the DATA keyboard can directly specify the frequency to which the marker is to be positioned. IF a frequency outside the present frequency display range is entered with the DATA keyboard, the marker is positioned to the leftmost or rightmost graticule.

The readouts of marker frequency and amplitude change with the movement of the marker.

MARKER

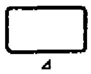


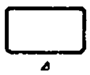
When another function key (such as CENT. FREQ.) is pressed, the marker is deactivated. To activate the marker again press MARKER. A marker which can be controlled with the DATA controls is called an active marker.
When a marker is active, the marker can be positioned on the desired trace by operating the VIEW or WRITE key for the trace memory A, A', B, or B' (see Section 4-10-1(6)).

4-9-2. MKR OFF

Operation of the MKR OFF key clears all markers from the display. If the MARKER key is pressed, a marker will appear again on the last marker spot.

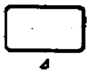
4-9-3. Δ (Delta) Key

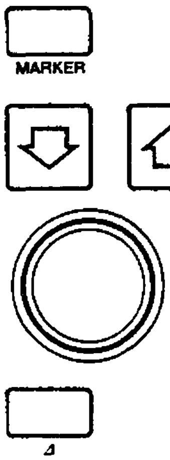


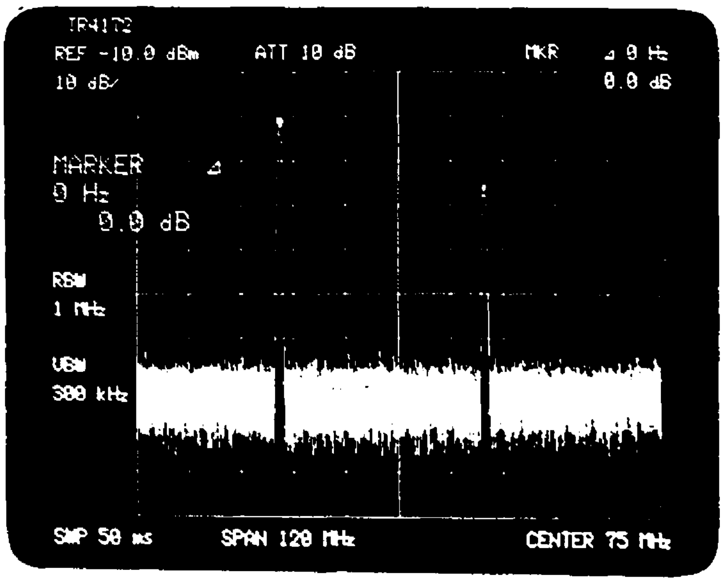


presents two markers on the display. Only one of the two markers is activated and the differences in frequencies and amplitudes of the two markers are read out. The following example shows a measurement of frequency and amplitude differences between two signal responses:

Press MARKER to obtain the normal marker mode in which a marker is activated. Position the marker to the peak of one signal response with 

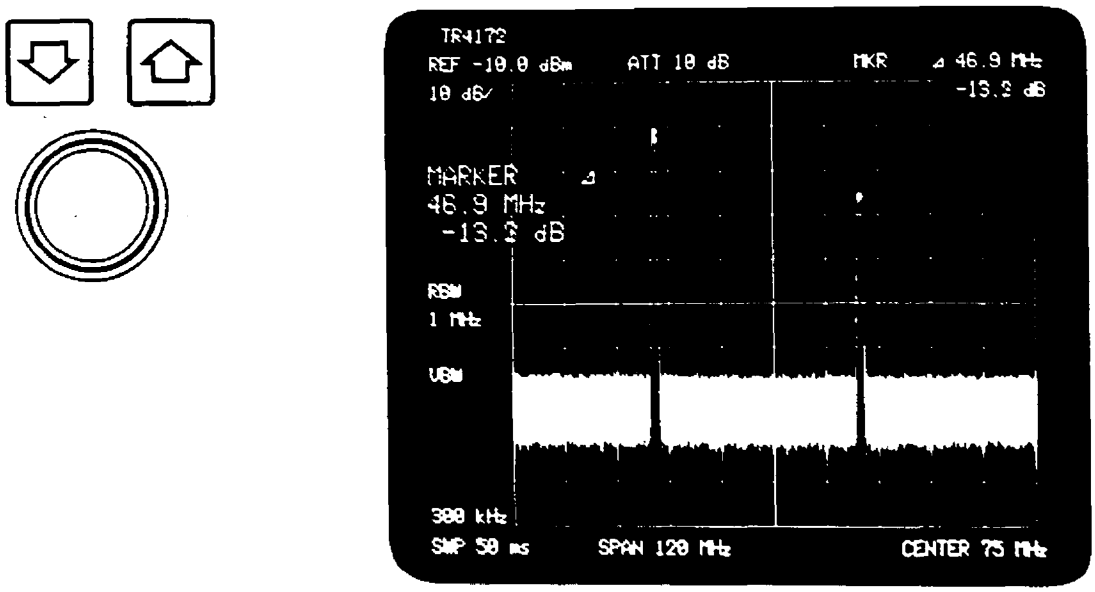
Press . The display will presents a second marker which is active. The first marker is deactivated and remains at the peak of the first signal response. The two markers overlap each other and appear as if a single marker.





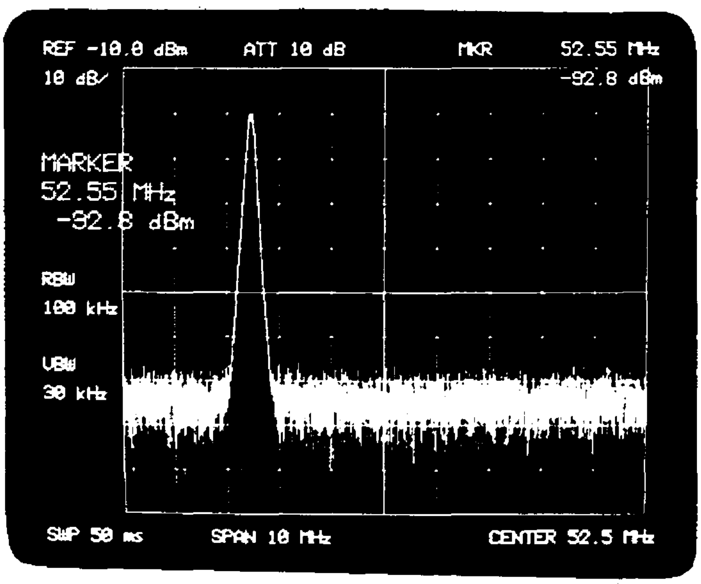
Position the second marker to the peak of the second signal response trace with  . Now the differences in the frequencies and amplitudes of the two signal responses are directly read out.

To return the analyzer from delta mode into normal marker mode press the MARKER key. Only one active marker will be left on the display.

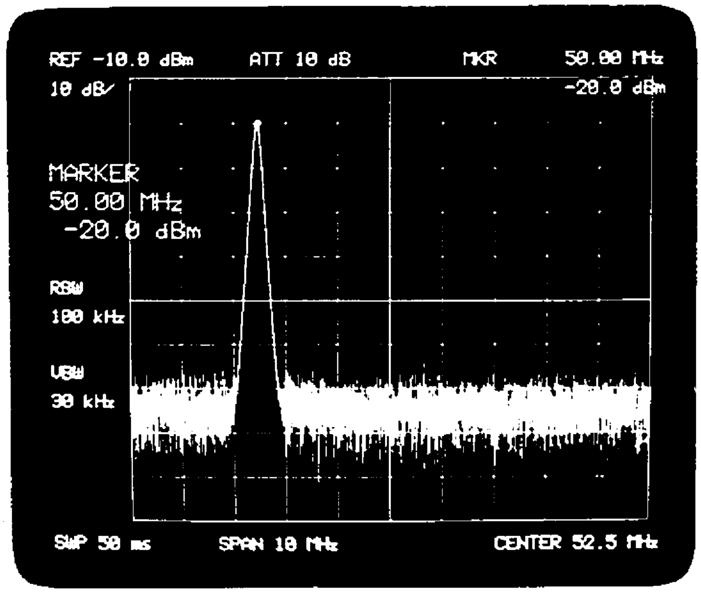


4-9-4. PEAK SEARCH

Operation of the PEAK SEARCH key places a single marker at the peak of the maximum trace response.



PEAK SEARCH



Successive peak search

If [SHIFT] [LABEL] [PEAK SEARCH] are pressed, the analyzer enters successive peak search mode, in which the active marker repeats peak searching after each sweep.

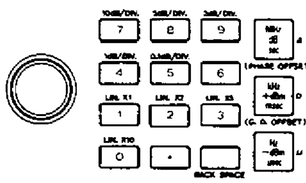
Pressing MKR OFF key cancels the successive peak search mode and erases the marker.

4-9-5. ZOOM

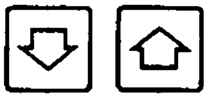
ZOOM

Use of the ZOOM key with the DATA step keys can zoom in a signal specified by a marker. In other words, the zoom operation narrows the frequency span and positions a marker to the center of the CRT display.

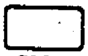
In the zoom mode, the DATA controls have functions different from those in other modes.



: The DATA knob and DATA keyboard control marker position.

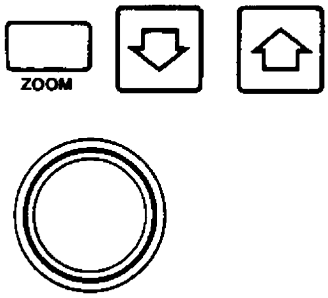
 :

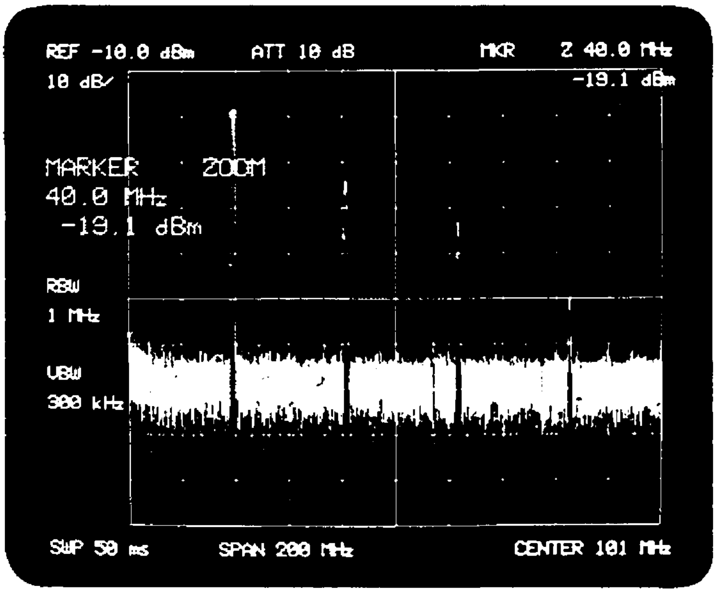
The Data step keys position a marker to the center of the display while controlling the frequency span.

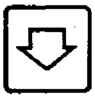


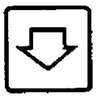
presents an active marker on the display.

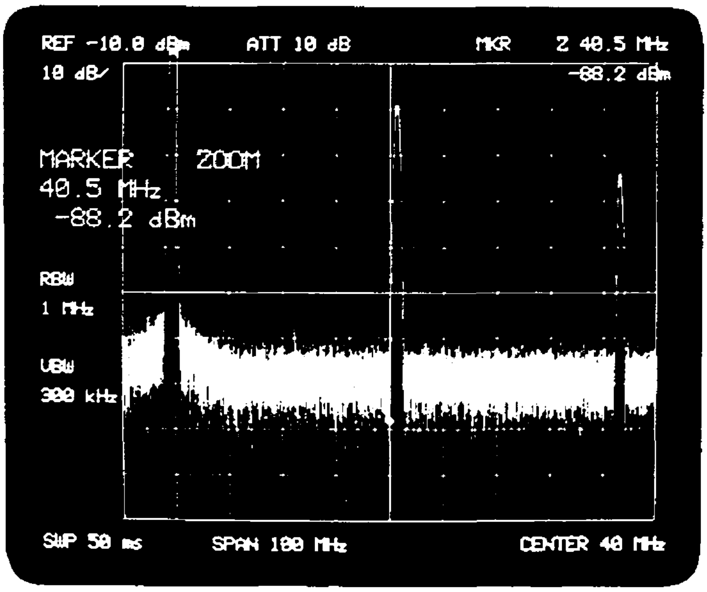
Position this marker to the peak of the signal response trace to be measured.

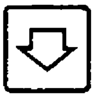


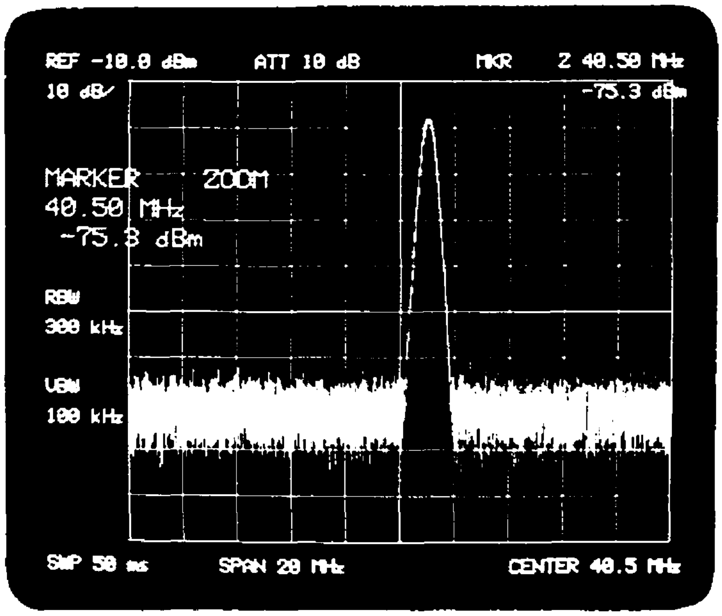


Each time  is pressed, the frequency span is narrowed in 1-2-5 sequences while the marker is moved towards the center of the display.









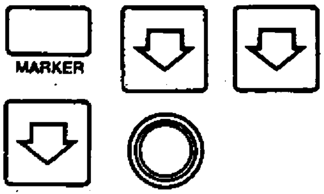
If the marker deviates from the signal peak as shown above, reposition it to the peak with the DATA control.

To return the analyzer from ZOOM mode to normal MARKER mode press the MARKER key.

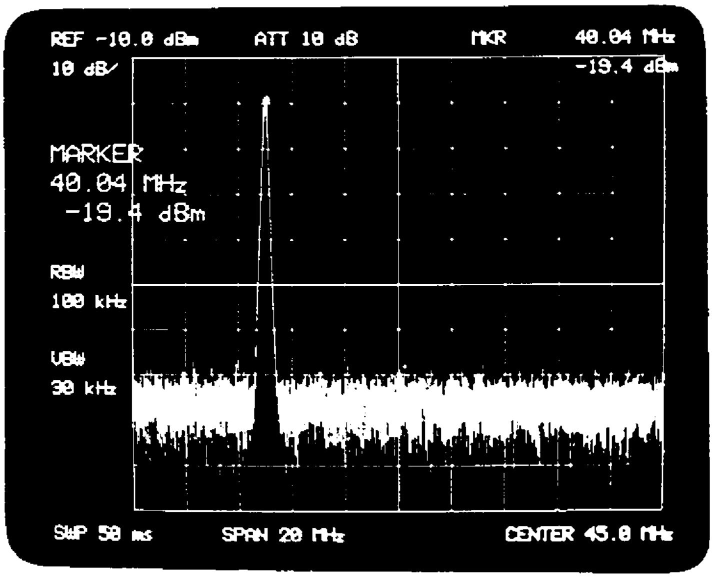
4-9-6. MKR → CF

Operation of th MKR → CF key substitutes a marker frequency for a center frequency.

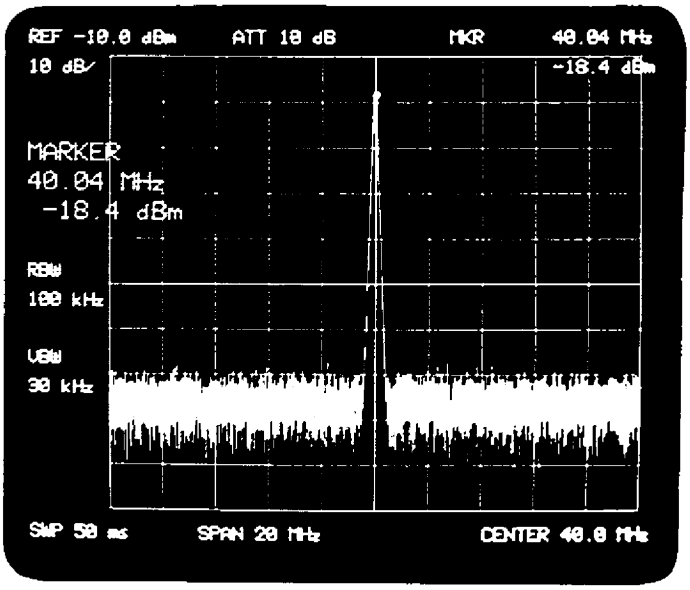
Press MARKER to activate a single marker and then position the marker to the peak of the signal response trace with DATA knob.



The signal frequency is read out as 40.04 MHz.



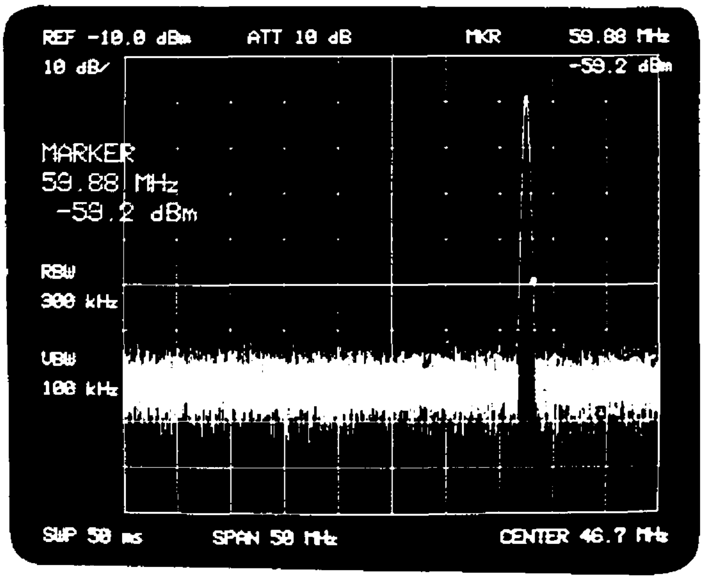
Press the MKR → CF key. The center frequency is set at 40.0 MHz and the signal response trace is positioned to the center of the display along with the marker.



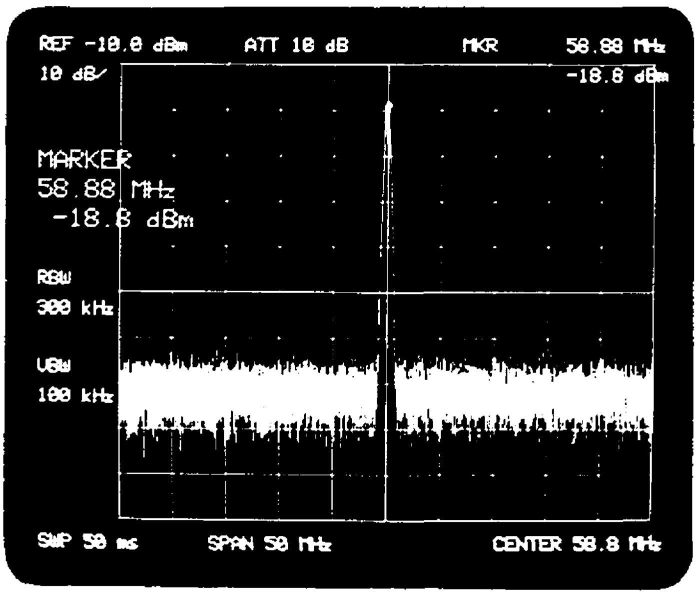
To press the MKR → CF key more than once, wait until the first marker repositioning is finished, then press the MKR CF key for the second time.

4-9-7. SIGNAL TRACK [SIGNAL TRACK]

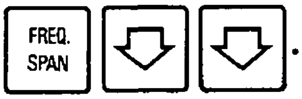
The analyzer can automatically maintain a drifting signal at the center of the display. To operate signal tracking, press [SIGNAL TRACK]; the indicator lamp on the key will go on to indicate that the signal tracking mode is entered.
A second depression of the SIGNAL TRACK key will turn off the key indicator lamp and return the analyzer to the normal MARKER mode. Operation of the MARKER, OFF, Δ, or PEAK SEARCH key also clears the SIGNAL TRACK mode and activates the corresponding mode for which the key is pressed.

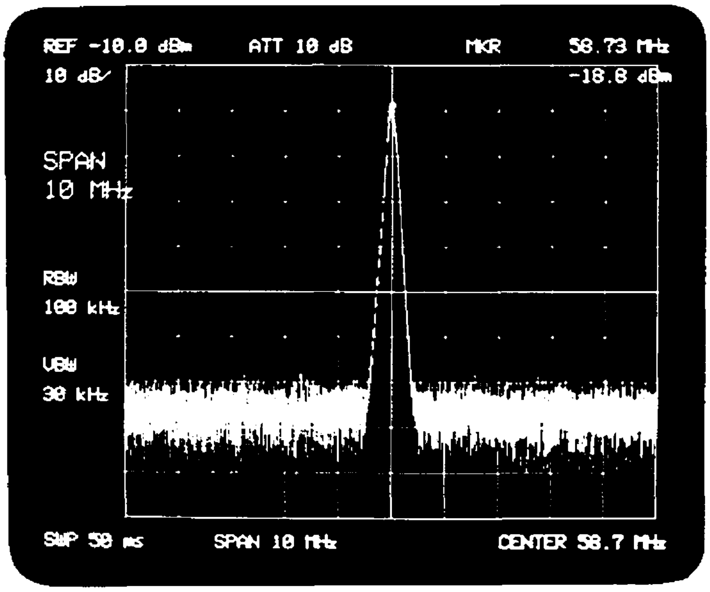


[SIGNAL TRACK]



A drifting signal can be zoomed in the SIGNAL TRACK mode with





On the above example of the signal tracking mode, the frequency span was narrowed by using the "DATA STEP DOWN" key several times. Instead of using the key, the desired frequency span can be directly entered from the DATA keyboards. After the entry of the narrower frequency span by the DATA keys, the signal is zoomed step by step, tracking the signal at the center of the display. During this

zooming of the signal tracking mode, "AUTO ZOOM" is displayed at the active function area, and all the keys but the SIGNAL TRACK and MKR. OFF keys are inoperative until the zooming stops. To stop the auto zooming on the signal tracking mode, use either of the above two switches.

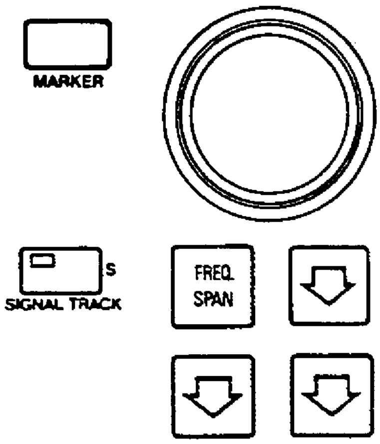
4-9-8. MKR/Δ → STEP SIZE [MKR/Δ →STEP SIZE]

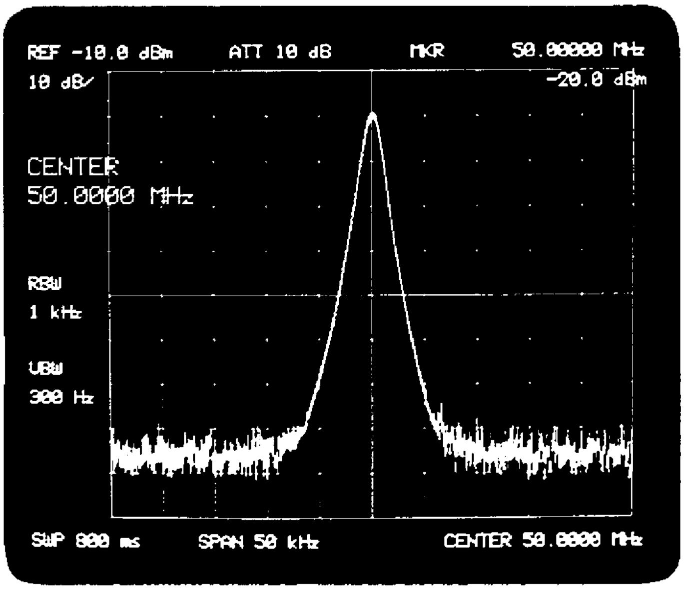
(1) In the normal MARKER mode, operation of the [MKR/Δ →STEP SIZE] key substitutes marker frequency for center frequency step size data.

(2) In the DELTA MARKER mode, operation of the [MKR/Δ →STEP SIZE] key substitutes frequency difference between two markers for center frequency step size data.

(3) Center frequency can be controlled in steps with [CENT. FREQ.] and [⇩] [⇧] with the step size determined in above steps (1) or (2).

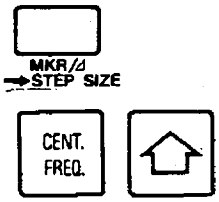
For example, when measuring a fundamental wave and its higher harmonics, press MARKER switch to activate a single marker and position it to the peak of the fundamental wave.
Then use the SIGNAL TRACK, FREQ. SPAN, and DATA step keys to zoom in on the fundamental wave at the center of the display.

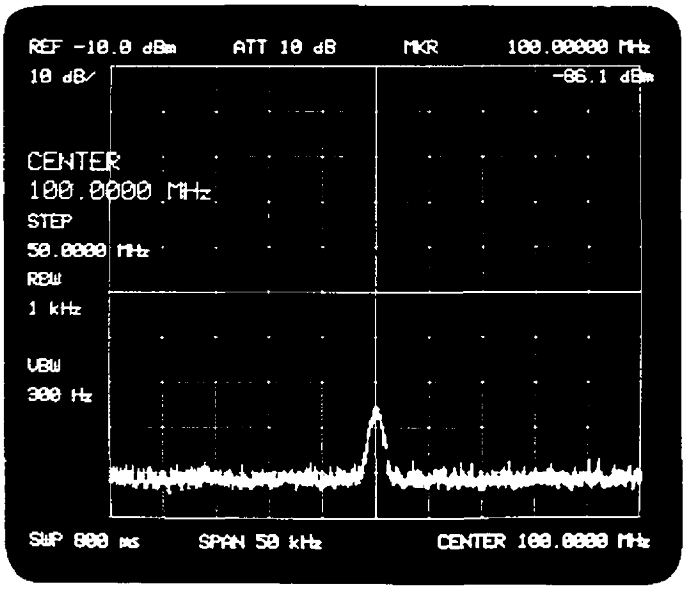




Next press the MKR/Δ →STEP SIZE key to substitute the marker frequency (fundamental wave frequency) for the center frequency step size; the indicator lamp on the CF STEP SIZE key will light.
Press the CENT. FREQ. key to activate center frequency, then press  . The center frequency is doubled and the second harmonic can now be observed.

Each time  is pressed subsequently, the third, fourth, and subsequent harmonics can be observed.





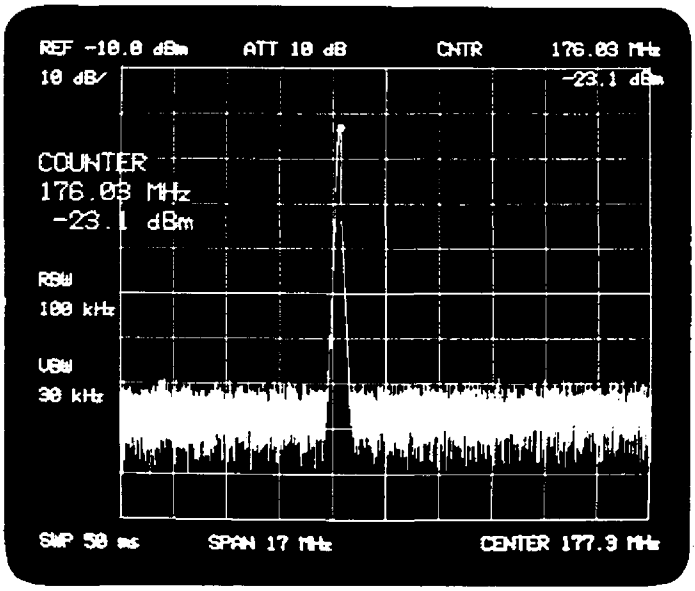
4-9-9. T.G. CNTR SHIFT T.G. CNTR

The T.G. CNTR mode counts the frequency of signals with great precision and accuracy. To activate the T.G. CNTR mode press SHIFT T.G. CNTR; the T.G. CNTR indicator lamp lights.

In the normal MARKER mode marker frequency is calculated from the marker position on the graticule and the center frequency, whereas in the T.G. CNTR mode, marker frequency is directly counted by the built-in counter.

Marker frequency is read as CNTR XXX Hz at the top right corner of the display. To return the analyzer to the normal MARKER mode press SHIFT T.G. CNTR a second time; the T.G. CNTR indicator lamp will go off.

SHIFT T.G. CNTR



In the T.G. CNTR mode the resolution of the counter can be increased up to 1 Hz as follows:

Press the SHIFT key and then the FREQ. CNTR key to activate the T.G. CNTR mode. Then press SHIFT CNTR RESOLN . The display will show message COUNTER RESOLN.

Now enter the desired resolution data (least significant digit) from the DATA keyboard.

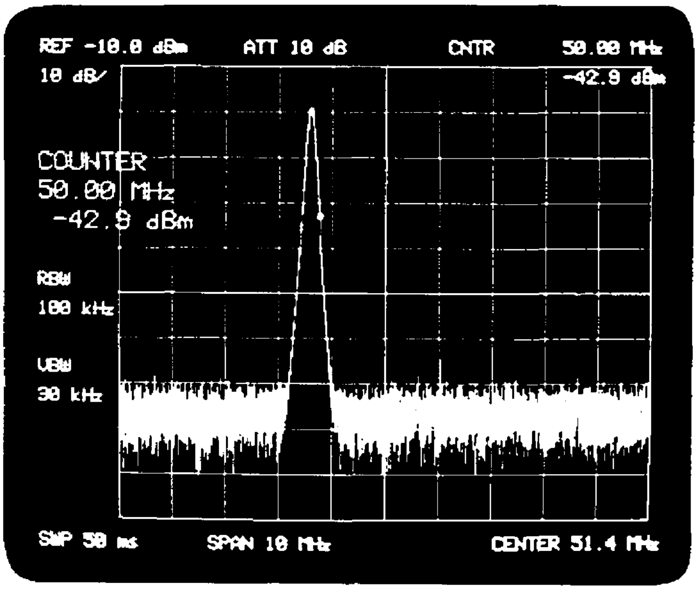
Note that an excessively high counter resolution causes an extended gate time and hence delayed display writing. Also note that signal tracking is not usable in the T.G. CNTR mode.

4-9-10. FREQ. CNTR [FREQ. CNTR]

Operation of the [FREQ. CNTR] keys activates FREQ. CNTR mode; the indicator lamp on the key will light.

The FREQ. CNTR mode permits precision measurement of the frequency of a signal (on which a marker is positioned) the level of which is more than 15 dB higher than the noise level. For the measurement the marker need not be positioned at the signal peak.

FREQ. CNTR



The frequency readout indicates not the marker frequency but the frequency of the signal on which the marker is positioned, though the amplitude readout indicates the amplitude at the marker.

In the FREQ. CNTR mode the title for frequency and amplitude readouts is COUNTER or CNTR, which is the same as that in the TG CNTR mode.

To increase the frequency counter resolution, press [SHIFT] [CNTR RESOLN] and then enter the desired resolution data (least significant digit to be read) from the DATA keyboard. To return the analyzer from the FREQ. CNTR mode into the normal MARKER mode press [FREQ. CNTR] again. The indicator lamp on the key will go off to indicate that the normal MARKER mode is restored.

CAUTION

For products having serial numbers below 30690130, a [TUNED AMP. / FREQ. COUNT.] key is installed instead of a [T. G. CNTR / FREQ. CNTR] key, and different designations are used for these keys. The normal mode and shift mode functions of the keys of the old and new products are reversed. (See the table below.)

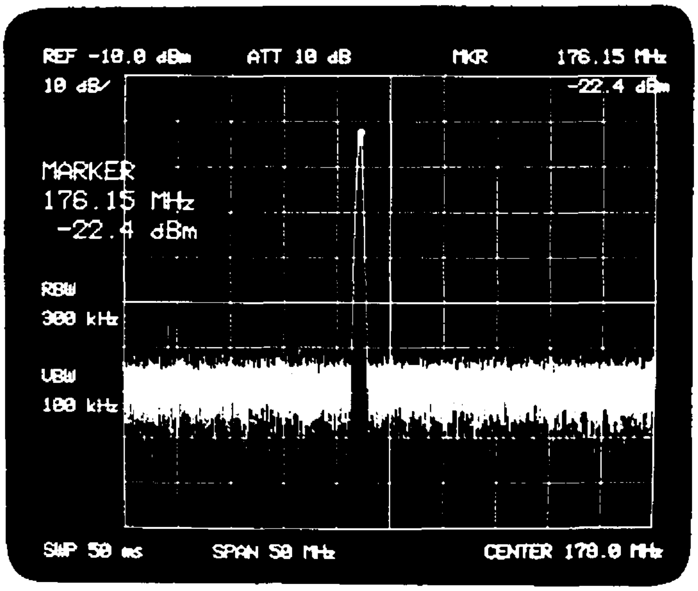
A GPIB program generated using the existing FC and SHFC codes can be used for the new product.

Function	Key operation		BPIB code
	Old product	New product	
Measures signals 15dB or more above the noise level and having a marker	SHIFT, TUNED AMP.	FREQ. CNTR	CN (SHFC)
Directly measures the marker frequency	FREQ. COUNT.	SHIFT, T. G. CNTR	SHCN (FC)

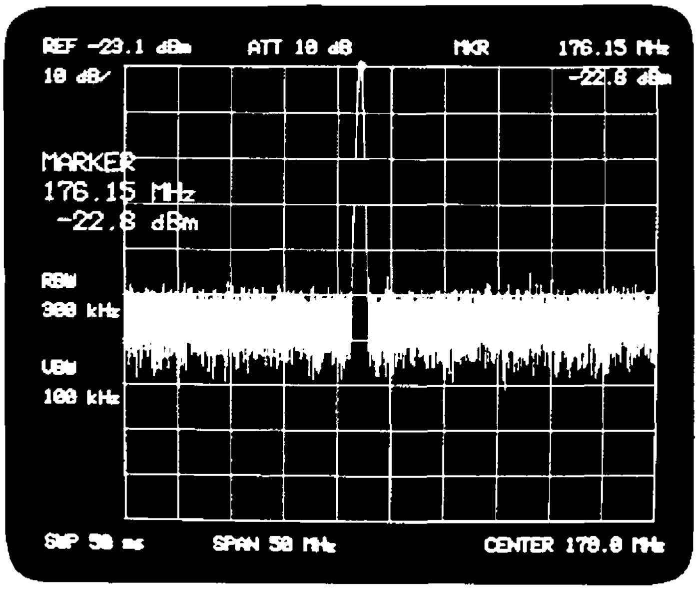
4-9-11. MKR → REF.

MKR → REF.

This key is used to substitute the amplitude at a marker for a reference level REF. LEVEL.



MKR → REF.



4-9-12. Multi Marker Mode

SHIFT MULTI MKR / MARKER

The Multi Marker mode allows the display to present more than one and up to ten markers at a time.

If SHIFT MULTI MKR are pressed, "MULTI MARKER" will be shown on the active function display area. Use the DATA keyboard to enter the number of markers to be displayed.

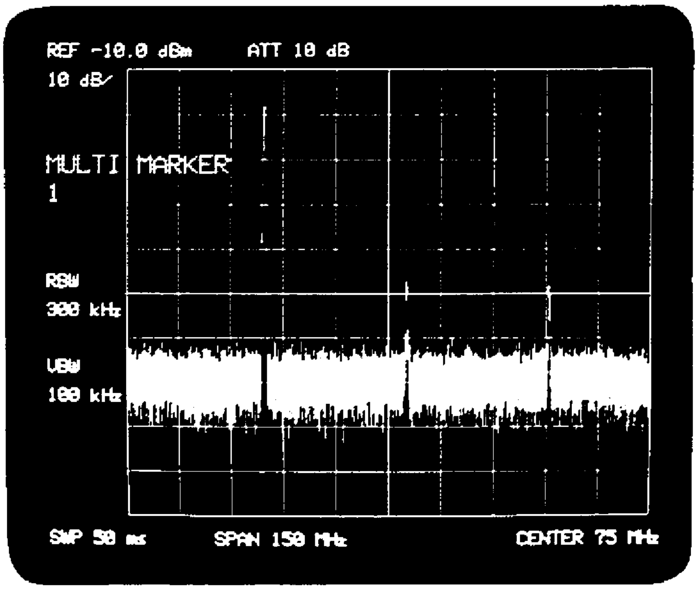
Then press the Hz key to register the entry data as the number of markers. Markers are presented on the display up to the programmed number each time the MARKER key is pressed. The following example shows display of three markers:

Press SHIFT MULTI MKR, then enter 3 Hz from the DATA keyboard. When the MARKER key is pressed the first time the first marker appears on the display. Position the marker to the desired signal response trace. The frequency and amplitude at the marker are shown on the active function display area and at the top right corner of the display. The second and third markers appear on the display when the MARKER key is pressed a second and third time respectively.

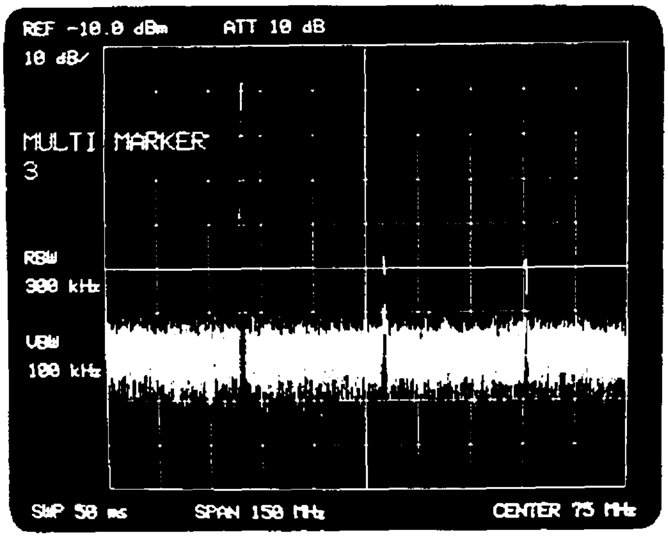
Set up the analyzer for

Multi Marker mode with

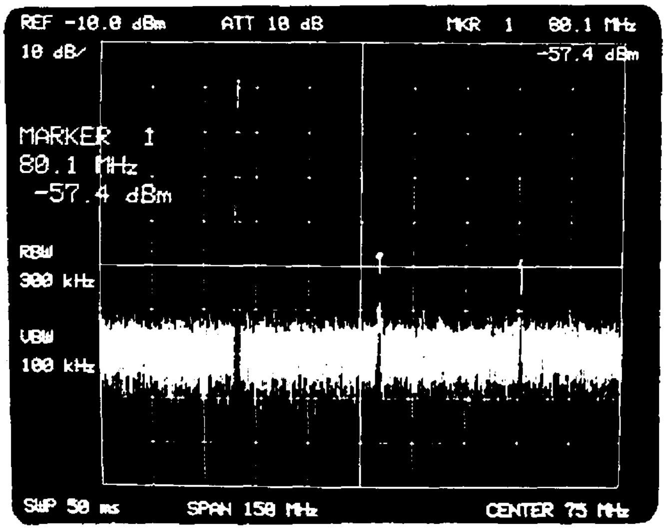
SHIFT MULTI MKR.



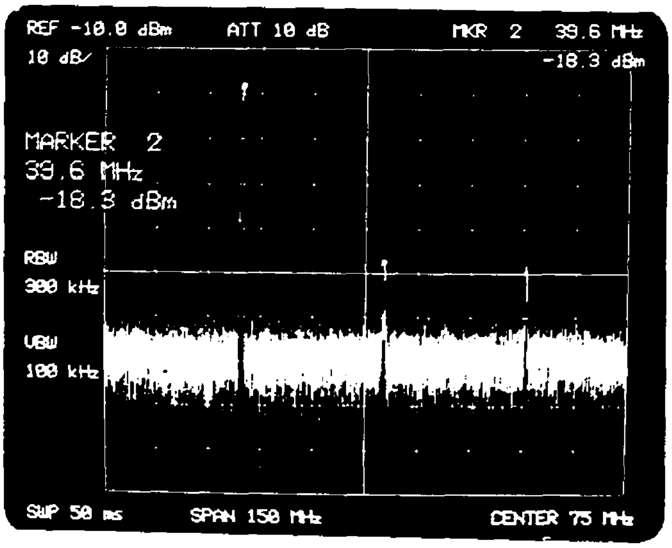
Set the number of markers to 3 with [3] [Hz –dBm µsec].



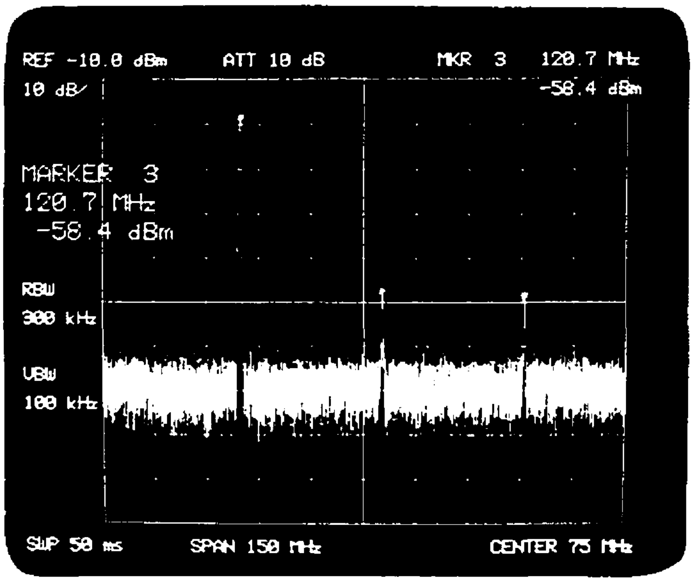
Activate the first marker (MKR 1) with [MARKER] and place the marker on a signal with (knob).



Generate the second active marker (MKR 2) with [MARKER] and place the marker on a signal with (knob). The first marker is deactivated.



Generate the third active marker (MKR 3) with [MARKER] and place the marker on a signal with ( ).



Now there are three markers presented on the display. Subsequent operations of the MARKER key will activate the three markers successively.

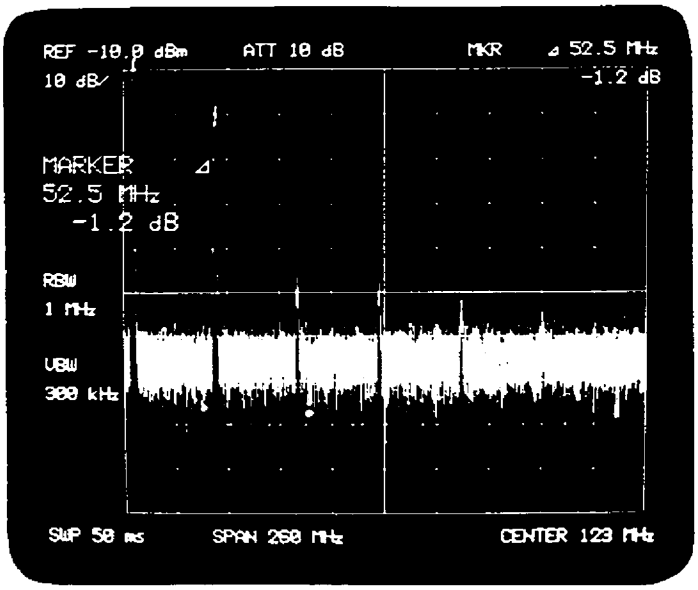
An active marker is highlighted. Operation of the MKR OFF key erases all markers from the display, yet the last positions of the markers and the programmed number of multi markers are left in the internal memory. So the markers can be recalled on the display one after another each time the MARKER key is pressed. To change the programmed number of multi markers press [SHIFT] [MULTI MKR], then enter the new number of markers (between 1 and 10) from the DATA keyboard before pressing the Hz key.

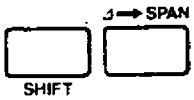
To return the analyzer from Multi Marker mode into the normal MARKER mode, set the number of multi markers to 1 with

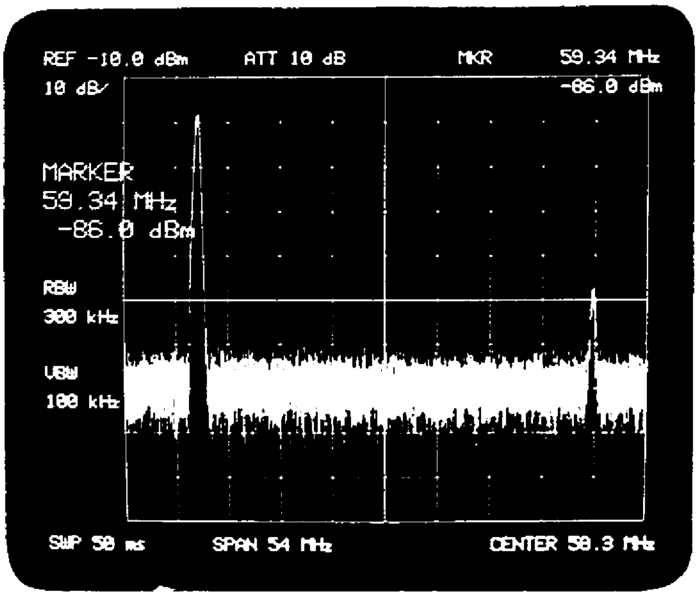
[SHIFT] [MULTI MKR / MARKER] [1] [Hz / −dBm / usec].

4-9-13. Δ → SPAN

If [SHIFT] [Δ → SPAN] are pressed when the analyzer is in the Delta Marker mode, the center frequency and frequency span are set so that the frequency range between two markers occupies the entire frequency span. In this case the two markers need not be active.



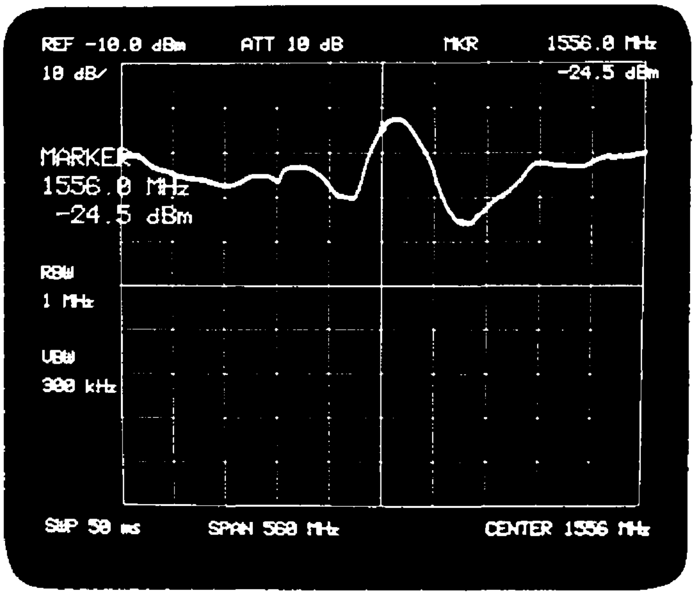


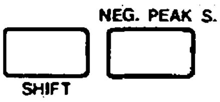


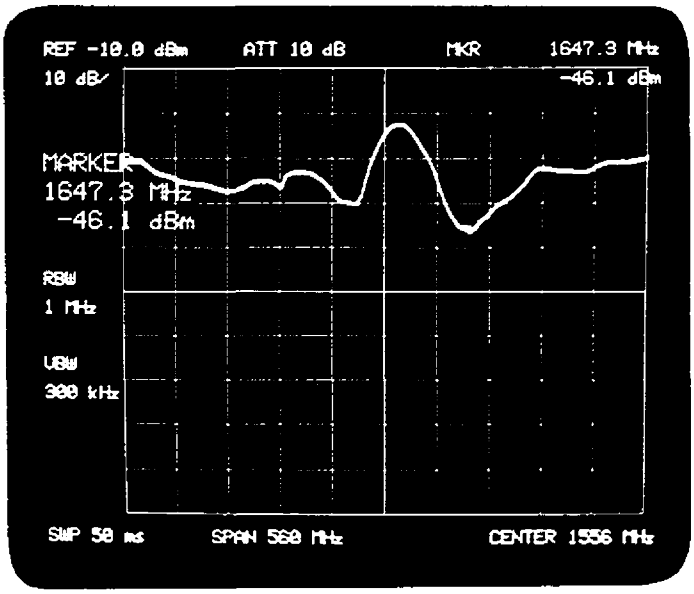
The analyzer is returned from the Delta Marker mode to the normal MARKER mode with a marker appearing at the center of the display.
The frequency span is slightly greater than the difference in the two marker frequencies (Δ).
The center frequency is set at the left-side marker frequency plus span/2.
In the Delta Marker mode the Δ → SPAN key is operative irrespective of whether the left or right marker is active.

4-9-14. NEG. PEAK S.

Operation of the SHIFT and NEG. PEAK S. (Negative peak search) keys places an active marker at the bottom of the lowest signal response trace.







4-9-15. Noise Level Measurement

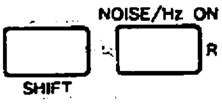
When noise level measurement is activated and the marker is placed in the noise, the rms noise level is read out normalized to a 1 Hz noise power bandwidth. To activate the noise level measurement press

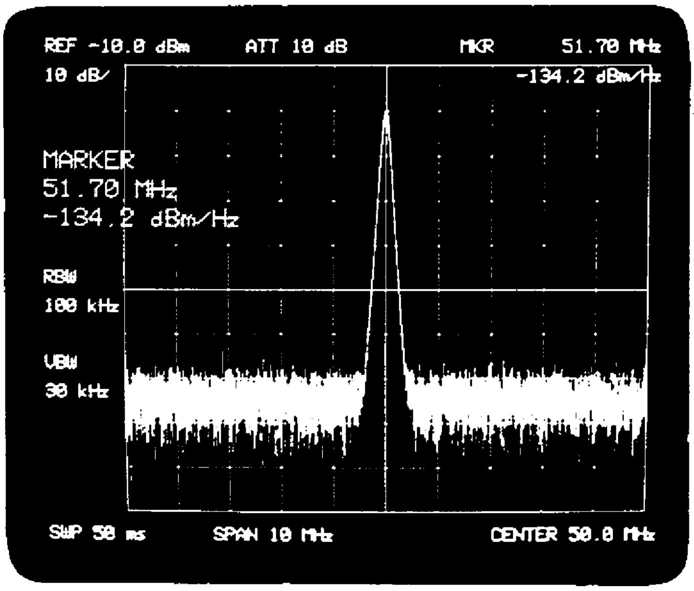
[SHIFT] [NOISE/Hz ON] R.

The marker level readout on the display reads XX dBm/Hz, indicating the noise level measurement mode. To obtain a noise level over a bandwidth greater than 1 Hz, add the following value to the readout:

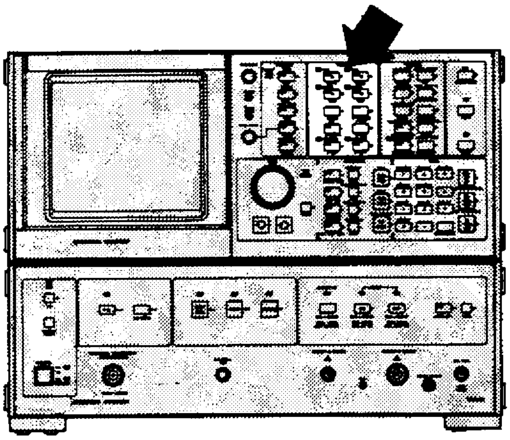
$$10 \log_{10} \left(\frac{\text{bandwidth}}{1\ \text{Hz}}\right)$$

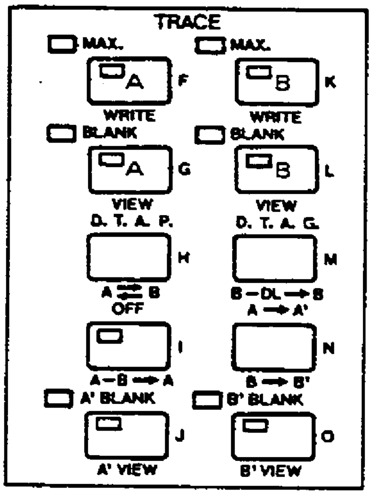
To return the analyzer from the noise level measurement mode to the normal MARKER mode, press [SHIFT] [NOISE/Hz OFF] S.





4-10. TRACE

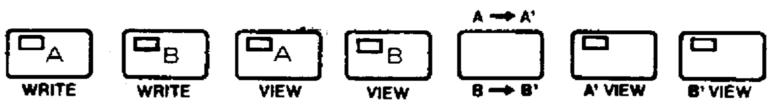




In the TRACE mode, up to four different signal response traces are converted to the corresponding digital information and stored in internal trace memories which can then be transferred to the CRT display. The trade memory consists of memories A, A', B, and B'. Memories A' and B' are auxiliary to memories A and B respectively. This section describes the basic operating procedures in the TRACE mode, then presents simultaneous four trace display.

4-10-1. Basic Operation Procedures in TRACE mode

(1) WRITE and VIEW



WRITE and VIEW keys are provided for memories A and B.

When the WRITE key is pressed, the analyzer signal response is written into trace memory during the sweep and the memory contents are displayed on the CRT.

As a result, the signal response trace on the CRT varies with sweep rate.

When the VIEW key is pressed, no updating of the trace memory is made and the result of the latest sweep is saved and displayed on the CRT.

The WRITE mode can be selected for only either of memory A or memory B at a time.
Memories A' and B' have only VIEW keys and have no WRITE keys. The A → A' (B → B') key is used to write information into memories A' and B', respectively.

a. WRITE A

   When the WRITE A key is pressed, the analyzer signal response is written into trace memory A during each sweep and the memory contents are displayed on the CRT. The indicator lamp on the WRITE A key goes on to indicate the WRITE A mode. When the analyzer is initially switched on or the MASTER RESET key is pressed, the instrument is automatically placed in the WRITE A mode.

b. VIEW A

   If the VIEW A key is pressed in the WRITE A mode, updating of trace memory A is no longer made and the current memory data is displayed on the CRT.
   If the VIEW A key is operated in the BLANK A mode (to be described later), the contents of trace memory A is recalled on the CRT.

c. WRITE B

   When the WRITE B key is pressed, the analyzer signal response is written into trace memory B during each sweep and the memory contents are displayed on the CRT.
   The indicator lamp on the WRITE B key goes on to indicate the WRITE B mode.
   The WRITE mode can be selected for only either of memory A or memory B at a time. The memory for which the WRITE key is pressed most recently is placed in the WRITE mode. If the WRITE B key is pressed in the WRITE A mode, memory A is placed in the VIEW A mode and memory B is placed in the WRITE B mode. In this case, active contents of memory B are overlapped on stationary trace A.

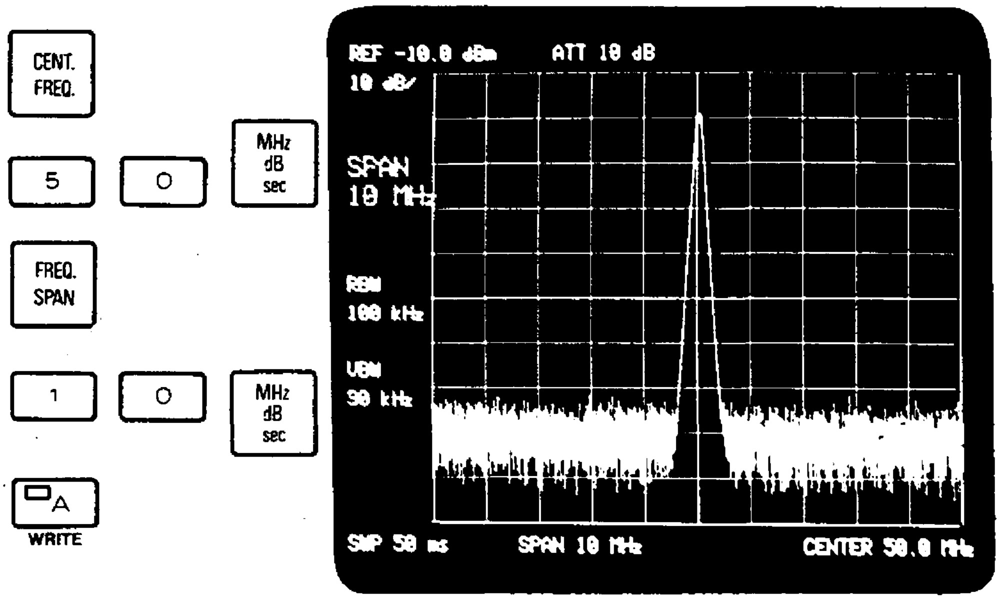
d. VIEW B

   If the VIEW B key is pressed in the WRITE B mode, updating of trace memory B is no longer made and the current memory data is displayed on the CRT.

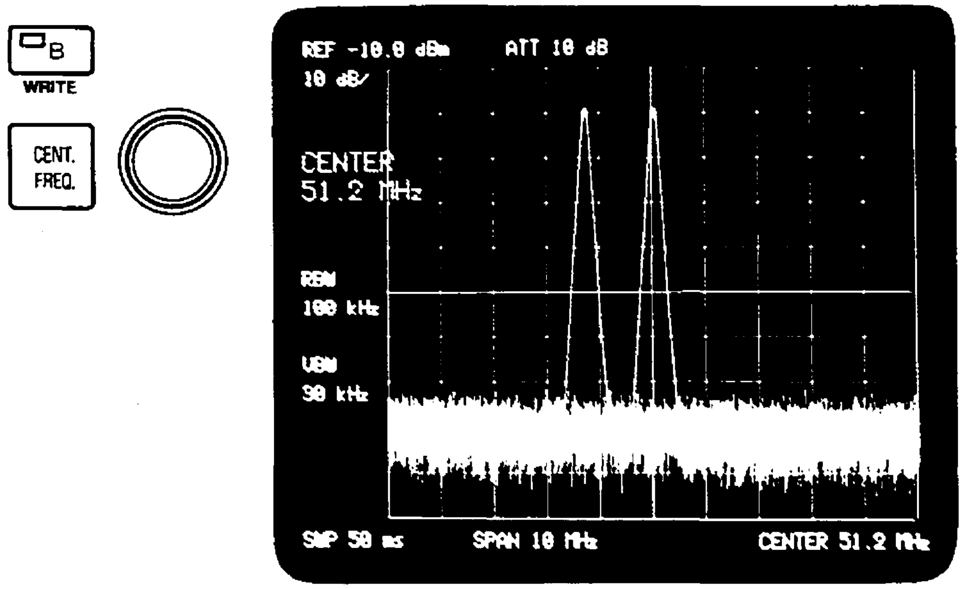
e. Example of WRITE and VIEW mode usage

A simple example of the WRITE and VIEW mode usage using the CAL. OUT. signal is described below:

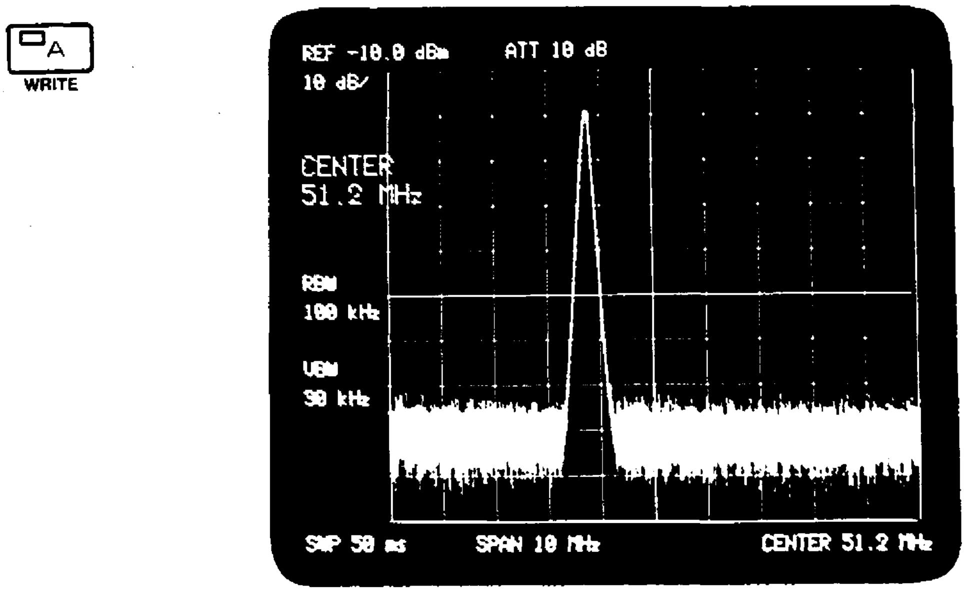
Press the AC key for INPUT-1. Connect the CAL. OUT. connector to the INPUT-1 connector with the supplied input cable MI-02 (with he N-BNC adapter JUG-201A/U attached to the INPUT-1 connector). Set the CENT. FREQ. to 50 MHz and FREQ. SPAN to 10 MHz. IF the analyzer is not in the WRITE A mode press the WRITE A key.



Then press the WRITE B key. Trace memory B is placed in the WRITE mode and memory A is placed in the VIEW mode with trace A frozen. Press the CENT. FREQ. key and adjust the DATA knob. Active trace B can now be observed together with inactive trace A.



Press the WRITE A key again to select the WRITE A and VIEW B mode. Trace A is now overlapped with frozen trace B.



f. B → B', A → A', VIEW A', VIEW B'

These keys are used to transfer the contents of memory B to memory B' or those of memory A to memory A'.

Pressing [B' VIEW] [B → B'] transfers the contents of memory B to memory B'.

Each trace is generated from 1001 points across the graticule. Odd numbered 500 points out of the 1001 points of trace B are written into memory B'. Even numbered 501 points leave in memory B.

A' VIEW SHIFT B → B' stores the contents of memory A in memory A'. The odd numbered 500 points out of the 1001 points of trace A are transferred to memory A', and the even numbered 501 points of trace A are left in memory A.

Be sure to press A' VIEW or B' VIEW before pressing B → B'.

(2) MAX.

In the MAX. mode the maximum signal response is held and displayed. At the end of each sweep, the new data is compared with old data in memory at each 1001 point and a larger signal response is stored in memory.

Operation of SHIFT MAX. A selects the MAX. A mode and the MAX. indicator lamp lights. Operation of SHIFT MAX. B selects the MAX. B mode.

The MAX. mode can be cleared by pressing the WRITE, VIEW or BLANK key for the pertinent memory.

(3) BLANK

BLANK A BLANK B A' BLANK B' BLANK

Unnecessary traces can be blanked from the CRT by using BLANK keys.

To blank trace A from the CRT, press SHIFT BLANK A to place memory A in the BLANK mode.

Since the contents of the momory are saved in the BLANK mode, they can be recalled on the CRT by pressing the VIEW key. The BLANK mode can be selected for memories B, A', and B' in much the same way.

If the BLANK key is pressed in the WRITE mode, updating of the memory is no longer made and the current memory data is saved, with the CRT blanked out.

If the BLANK key is pressed in the VIEW mode, a frozen trance is blanked from the CRT and is saved in memory.

The BLANK mode can be cleared by pressing the VIEW, WRITE or MAX. key.

If the VIEW A key is pressed in the BLANK A mode, the saved trace is recalled on the CRT. This procedure can be applied to memories B, A', and B' as well.

If the WRITE A key is pressed in the BLANK A mode, the analyzer is placed in the WRITE A mode and the saved memory data is erased from memory A, and the signal response is written into the memory at the sweep rate and then transferred to the CRT (same for memory B as well).

As mentioned earlier, when VIEW A' mode is selected with [A' VIEW] [SHIFT] [A → A'], only the even numbered 500 points (out of 1001 points) of trace A are transferred to the CRT. To display the full 1001 points of trace A again, press [SHIFT] [A' BLANK] to blank trace A' from the CRT, then press the WRITE A key.

(4) Trace exchange

[A ⇄ B] exchanges the contents of trace memories A and B. The contents of memories A' and B' are also exchanged at the same time.

(5) Trace subtraction

a. A-B → A

[A-B → A] subtracts the contents of memory B from those of memory B are subtracted from trace A from sweep to sweep and memory A or trace A and stores the result in memoty A.

If [A-B → A] is pressed in the WRITE A mode, the contents of the resulting trace is displayed. The indicator lamp on the [A-B → A] key lights to indicate the A-B → A mode.

If [A-B → A] is pressed in the VIEW A mode, the contents of memory B is subtracted from frozen trace A and the result is written intò memory A and then transferred to the CRT. The indicator lamp on the [A-B → A] key momentarily lights and memory A remains in the VIEW A mode.

If $\boxed{A-B \rightarrow A}$ is pressed in the WRITE B mode, memory B is placed in the VIEW B mode and the contents of memory B are subtracted from those of memory A and the result is written into memory A. The indicator lamp on the $\boxed{A-B \rightarrow A}$ key momentarily lights.

$\boxed{\text{WRITE A}}$ $\boxed{A-B \rightarrow A}$ selects the A-B → A mode, and $\boxed{\text{SHIFT}}$ clears the A-B → A mode to return the analyzer to the normal WRITE A mode.

b. B-DL → B

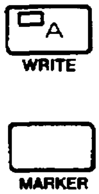
First place memory B in VIEW B mode. Then, press $\boxed{B-DL \rightarrow B}$. The display line level (to be described later) is subtracted from the contents of memory B (amplitudes at each point). If B-DL → B is pressed in the WRITE B mode, memory B is placed in VIEW B mode.

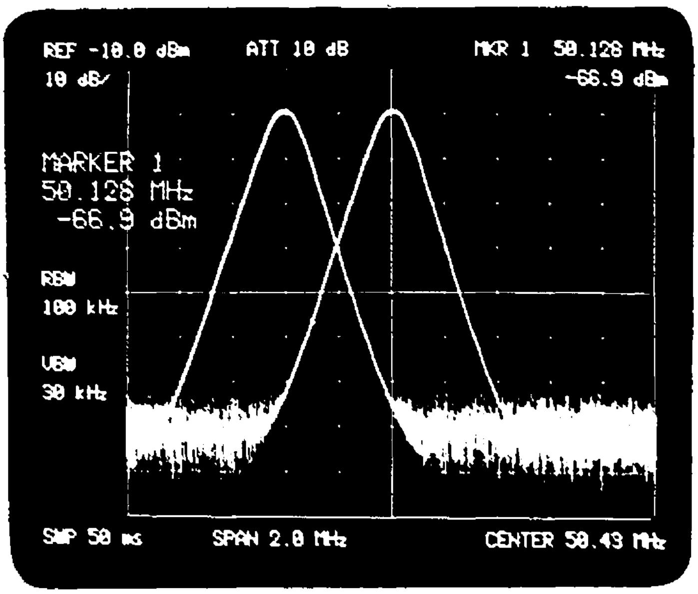
(6) Markers on memories A, B, A' and B'

If the WRITE or VIEW key for memory A or B or the VIEW key for memory A' or B' is pressed when an active marker is present on the CRT, the marker is repositioned to the memory for which the corresponding key is pressed. At this time the marker position on the horizontal graticule line remains unchanged. An inactive marker remains in its home memory even when one of the above keys is operated.

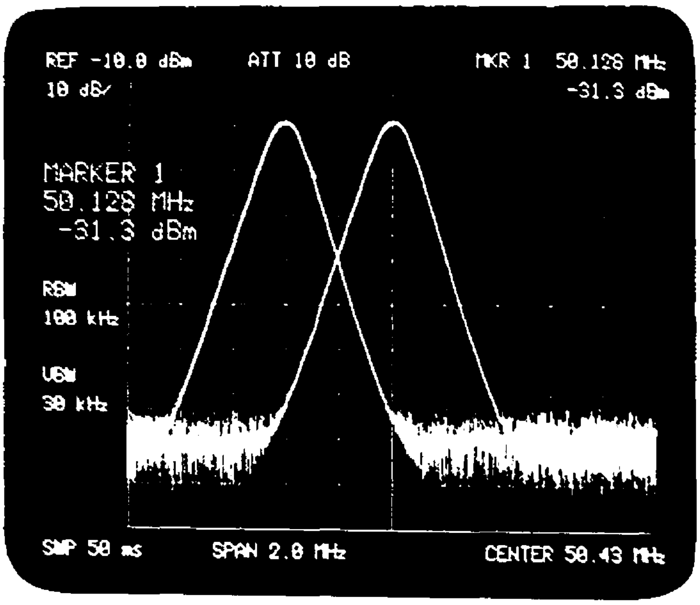
If one of memories A, B, A' or B' is placed in the BLANK mode, the marker for that memory is also blanked from the CRT. Marker repositioning is described below:

- Memory trace A (right) and memory trace B (left) are present on the display (see photo). Memories A and B are placed in the WRITE A and VIEW B modes respectively and an active marker is present on memory trace A.





If the VIEW B key is pressed the active marker is repositioned on trace B.



The marker moves on stationary trace B with the rotation of the DATA knob.
If the WRITE A key is pressed the marker is again repositioned onto trace A.

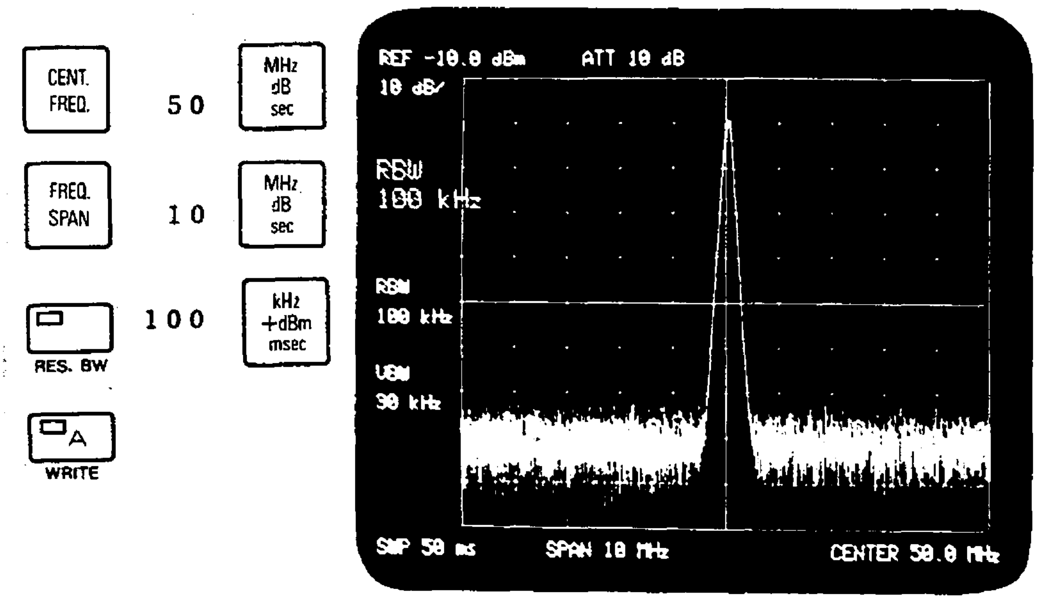
By utilizing this characteristic, differences in frequency and level between two traces can be read with a delta marker.
The reading procedure is described in the following:
First, activate a marker on a trace and position it to the desired position, then press [ ] Δ . Press a trace key (e.g. [B] VIEW) to reposition the active marker on the other trace, then position it to the desired position on that trace.
The differences in frequency and level between the two traces are now read out. Note, however, that those frequency and level differences are calculated from the setup conditions (frequency span, dB/div., etc.) currently shown on the display.

4-10-2. Simultaneous Four Trace Display

An example of simultaneous four trace display using the 50 MHz CAL. signal is given below.

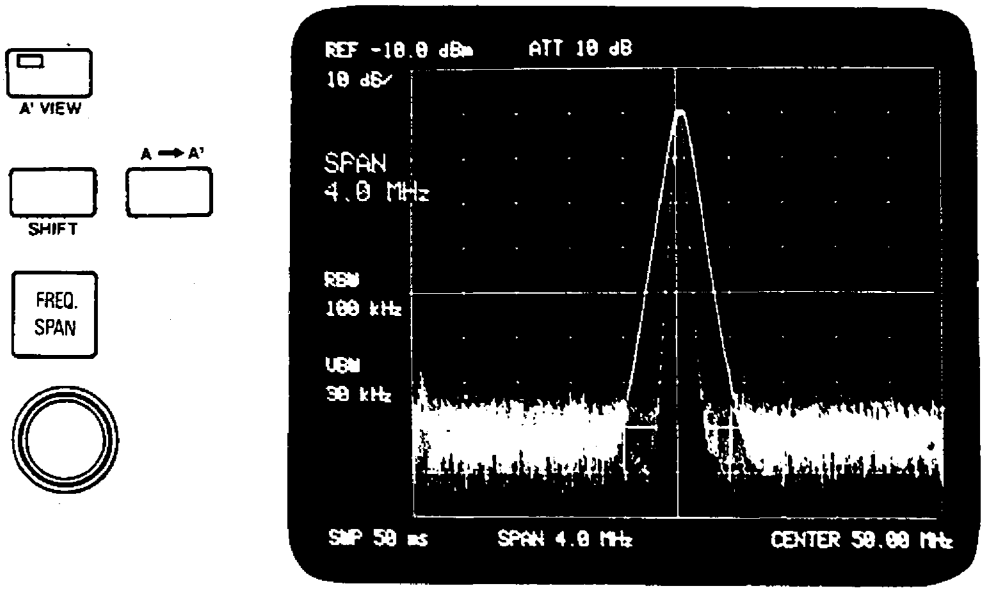
(1) Press the AC key for INPUT-1. Connect the CAL. OUT. connector to the INPUT-1 connector with input cable MI-02 (with the N-BNC plug adapter attached to INPUT-1).

(2) Set the center frequency to 50 MHz. The CAL. signal will appear at the center of the display.
Set frequency span to 10 MHz and resolution bandwidth to 100 kHz. Press the WRITE A key.

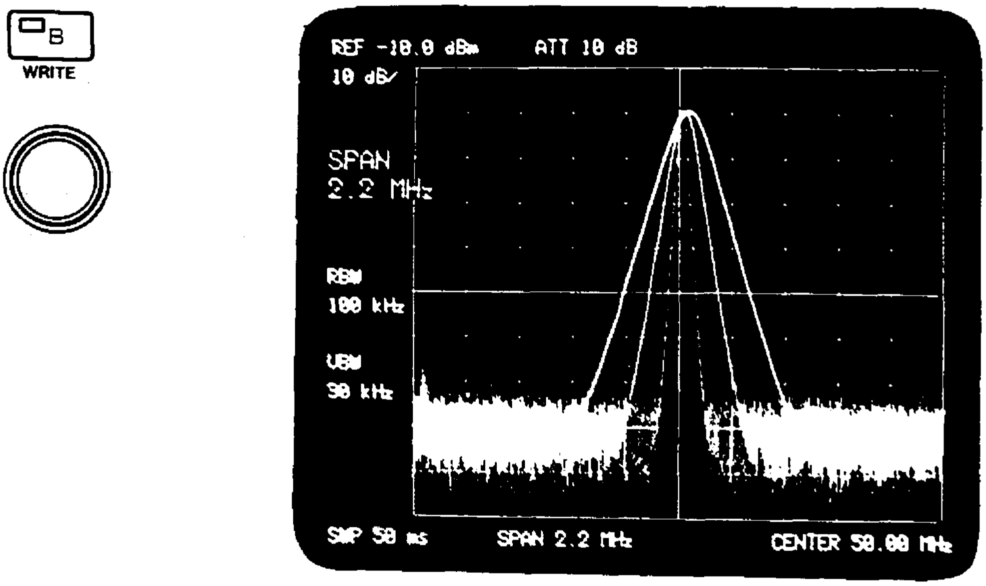


(3) Press [A' VIEW] and [SHIFT] [A → A']. The contents of memory A is transferred to memory A'. Traces A and A' cannot so far be discriminated from each other since the contents of memories A and A' are identical.

(4) Press the FREQ. SPAN key and then turn the DATA knob slightly counterclockwise to enlarge the trace. Now active trace A can be discriminatad from frozen trace A' on the display.

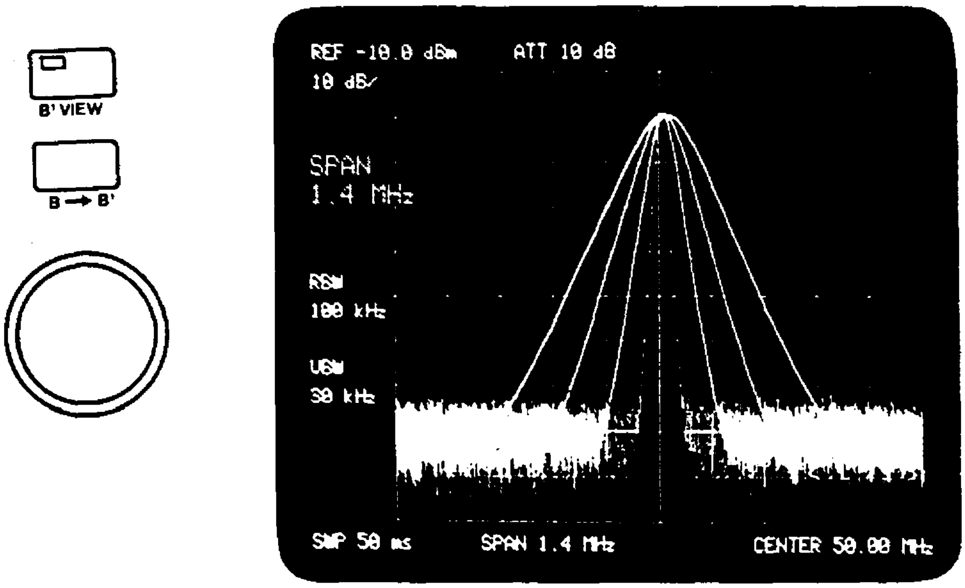


(5) Press the WRITE B key. Memory A is automatically placed in the VIEW A mode and trace A is frozen. Memory B can now be updated. Turn the DATA knob to enlarge trace B. Now three traces B, A, and A' are displayed.



(6) Press B' VIEW B→B' to transfer the contents of memory B to memory B'. Trace B cannot be discriminated from trace B' since the contents of memories B and B' are identical.

(7) Turn the DATA knob slightly counterclockwise to discriminate trace B' from trace B. Now four traces are displayed on the CRT at a time.



(8) Use the BLANK key to blank unnecessary trace from the display:

[SHIFT] [B' BLANK] blanks trace B'.

[SHIFT] [BLANK A] blanks trace A.

[SHIFT] [A' BLANK] blanks trace A'.

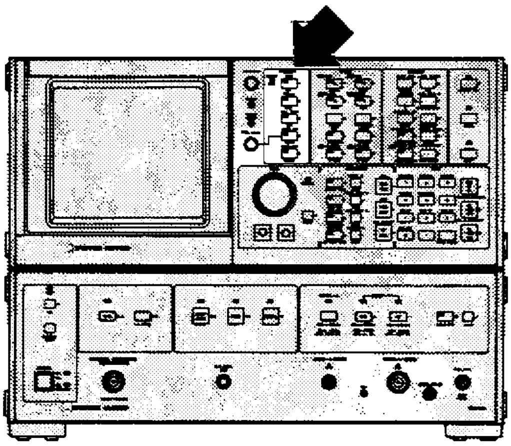
To recall a blanked trace on the CRT, press the VIEW key (e.g. [B' VIEW]).

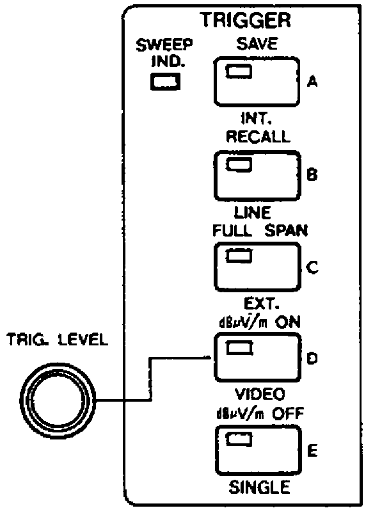
(9) If contents of trace A and trace B are desired to be exchanged under simultaneous four trace display preserving trace A' and trace B' as it is, it can be performed by the following operation.

Specify taces A, A', B, and B' to VIEW mode, and then press [SHIFT], [LABEL], [B] L keys

Note that traces A and B, and traces A'and B' are ecxchanged simultaneously, if [A⇄B] key is depressed.

4-11. TRIGGER





The analyzer sweep is triggered by selection of one of five modes.

(1) INT.

Automatically repeats internal triggering.

(2) LINE

Repeats triggering in synchronism with the line frequency.

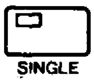
(3) EXT.

Allows the next sweep to start in synchronism with an external trigger signal (TTL compatible) supplied to the rear EXT. TRIG. connector. Triggering occurs at a HIGH to LOW transition of the external signal.

(4) VIDEO

Allows the next sweep to start if the detected IF envelope voltage rises to a level set by the TRIG. LEVEL knob. If the trigger fails, adjust the TRIG. LEVEL knob.

(5) SINGLE

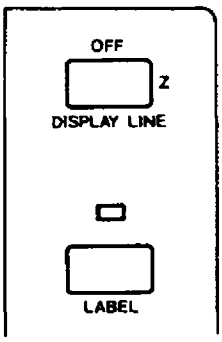


Allows the next sweep each time the SINGLE key is pressed.

(6) Trigger mode selection

One of the above five trigger modes should be selected. The indicator lamp on the selected key will light. Normally, set the trigger mode to INT.

4-12. DISPLAY LINE AND LABEL



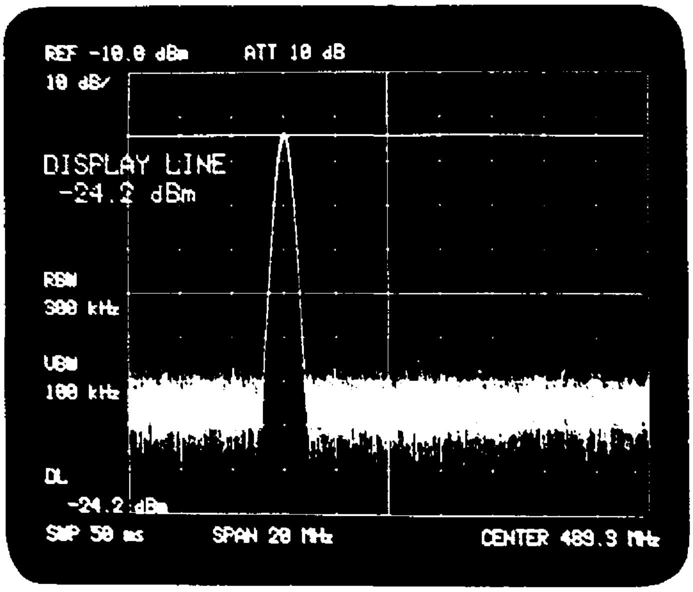
4-12-1. DISPLAY LINE [OFF / DISPLAY LINE]

[DISPLAY LINE] activates a display line (horizontal cursor line) on the display.

The display line can be positioned anywhere within the graticule by the DATA knob or DATA step keys. The display line level is read to the left side of the CRT as "DISPLAY LINE XX dBm". The same readout is always presented at the bottom left corner of the display as "DL XX dBm". The peak level of a signal response trace can be easily read out by positioning the display line to that peak level.

The DATA step keys move the display line one tenth of the total amplitude scale per step. The DATA knob moves the line in display unit increments for finer control.

[SHIFT] [OFF / DISPLAY LINE] erases the display line from the CRT display but does not reset the last position. If the display line is activated again with [DISPLAY LINE], it will return to its last position.



4-12-2. LABEL

[LABEL] selects the LABEL entry mode; the indicator lamp just above the [LABEL] key lights, a cursor (-) appears on the CRT, and the front panel keys have functions different from those in the normal mode.

The LABEL mode permits entry of optional alphanumeric characters in the top area of the CRT display. The green letters presented beside each key are entered in this mode. Up to 54 characters can be entered per line. The DATA keyboard can be used for entry of numerical characters.

A space can be created between characters by pressing the [ ]␣ (HOLD) key in the DATA section. If an entry error is made, press the BACK SPACE key on the DATA keyboard.

The last character will be erased and the cursor will backspace one character position.

When entry of a label is completed, press the SHIFT key. This will clear the LABEL entry mode and return the front panel keys to thier normal functions; the indicator lamp above the LABEL key goes off.

An entered label can be edited by deletion or insertion. For label editing, place the analyzer in the LABEL entry mode by pressing the LABEL key. The cursor position can be controlled with the DATA knob. To delete a label character, position the cursor to the character with the DATA knob and then press [⇩] once. To insert characters, position the cursor to the character location at which insertion begins and then press [⇧]. A space of five consecutive character locations will appear at and beyond the cursor position. Each time a character is inserted into this space, the five character space moves to the right by one character location. When insertion is completed, press [⇧] again.

A character at the cursor position can be overwritten. The old character at the cursor position is overwritten with a new character.

A character string entered in the LABEL mode can be cleared with [ ] (SHIFT) [ ]␣ (LABEL CLEAR). It is also cleared when the MASTER RESET key is pressed or the device is switched to the STANDBY state.

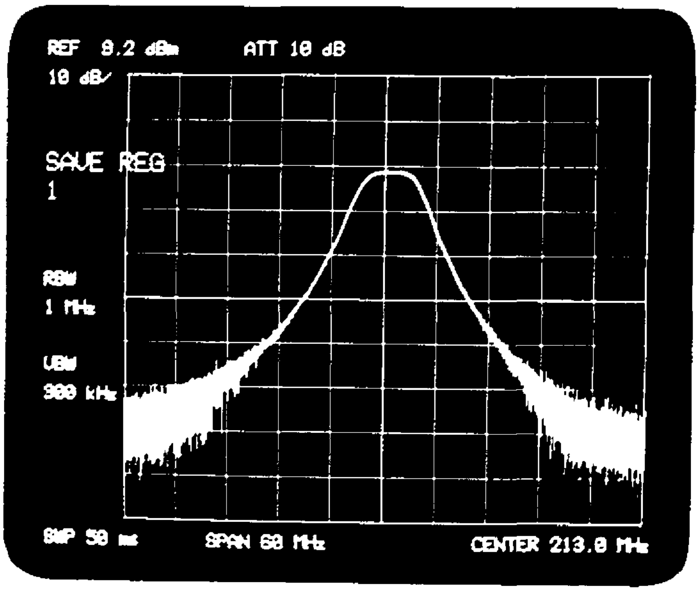
4-13. SAVE AND RECALL

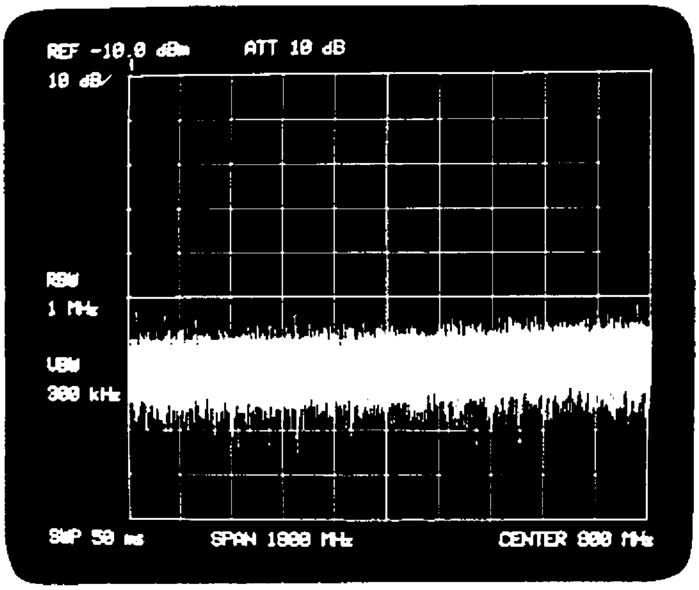
SAVE A RECALL B

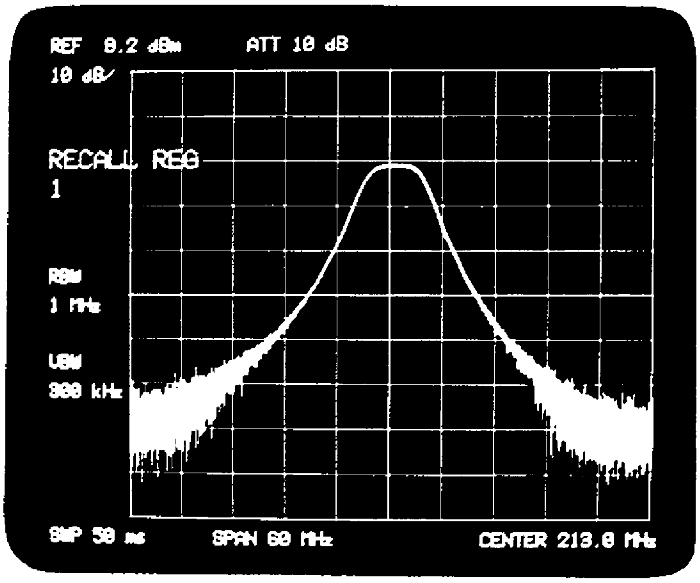
Up to 8 key statuses can be saved in internal registers and recalled as needed. To save the current key status press SHIFT SAVE, then press a numerical key between 1 and 8. The key status is saved in the register with the corresponding number. The saved key status can be recalled by pressing SHIFT RECALL and then the number key which corresponds to the register number from which the key status is to be recalled. When recalled, the current key status will be replaced with the saved key status.

The register contents remain intact even when the POWER switch is set to STANDBY. If the power cables of the instrument are unplugged from the outlets, the internal back-up battery maintains the register contents for about two weeks.

A label (character string entered in the top area of the CRT display) cannot be saved, nor can marker, trace, signal responses, or display line.







Save Registers 0 and 9 are also available as well as 1 through 8. However, the contents of Save Registers 0 and 9 may be changed when the MASTER RESET key is pressed, the power is turned off or the Error Correction Routine is executed or an optional function is executed.

4-14. SHIFT

SHIFT

When the SHIFT key is activated, a key operated immediately after the SHIFT key provides supplemental or unique measurement capability indicated by yellow characters above each key. Some keys require the double shift operation for which the LABEL key must be pressed after the SHIFT key is operated, such as SHIFT LABEL MHz dB sec .

The double-shift key functions include service switches. If the TR4172 malfunctions as a result of inadvertent activation of a service double-shift key sequence, presswitches. If the TR4172 malfunctions as a result of inadvertent activation of a service double-shift key sequence, presswitches. If the TR4172 malfunctions as a result of inadvertent activation of a service double-shift key sequence, press the MASTER RESET key. The appendix contains a listing of the double-shift key functions.

This paragraph covers the description of the shift key functions hitherto not covered in the preceding paragraphs.

4-14-1. Video Averaging (AVG.)

In the Video Averaging mode, signal response data is averaged while it is weighted in the time domain. Averaged data are added to new data under a certain weight by the preset number (N). Averaging is effective only in the WRITE A mode.

The Video Averaging mode allows a good signal-to-noise ratio without long sweep time.

The Video averaging of each amplitude point on the frequency axis is given by the following equation:

$$\overline{y}n = \frac{n-1}{n} \cdot \overline{y}n - 1 + \frac{1}{n} yn \quad (n \le N)$$

where yn: n'th data

$\overline{y}n$: n'th averaged data

$\overline{y}n - 1$: (n - 1)th averaged data

To activate video averaging, press SHIFT AVG. ON VIDEO BW * ; video averaging is immediately started.

The number of averaging is read to the top left corner of the display as "AVR XX", and the programmed number of averagings is read to the active function display area. (These readouts disappear when another function key is pressed.)

When the programmed number of averagings (N) is reached, $\frac{n-1}{n}$ and $\frac{1}{n}$ in the above equation are fixed to $\frac{N-1}{N}$ and $\frac{1}{N}$ respectively.

Averaging for n N is performed according to the following equation (however, the current averaging number readout on the display stops at n = N):

$$\overline{yn} = \frac{N-1}{N} \cdot \overline{yn - 1} + \frac{1}{N} yn$$

When the analyzer is initially switched on, the number of averagings is preset at 128. To modify this number, enter the desired number (2^n:64 for instance) from the DATA keyboard and then press one of the units keys. This technique allows programming of up to 4096 averagings. Averaging sequence temporarily stops and then restarts.

To disable averaging press [SHIFT] [AVG. OFF / CF STEP SIZE] m.

Do not change the analyzer's settings such as center frequency or frequency span while performing the video averaging. To change those settings, first stop the video averaging, then change those function settings, next restart the video averaging.

4-14-2. FULL SPAN (SHIFT C)

[SHIFT] [FULL SPAN] C sets center frequency to 900 MHz and frequency span to full 1800 MHz.

4-14-3. DETECTION (SHIFT n, p, s, z)

One of four detection techniques can be selected for displaying trace information.

(1) Normal Detection mode [SHIFT] [NORM. D.] n

The normal mode is initially selected when the analyzer is switched on. The positive and negative peak values are displayed alternately at each point on the frequency axis.

(2) Positive Peak Detection mode [SHIFT] [POSIT. PEAK D.] P

The positive peak detection mode displays signal maximums for the time period at each point on the frequency axis. "POS PK" is read in the active function display area.

(3) Negative Peak Detection mode [SHIFT] [NEG. PEAK D.] $

The negative peak detection mode displays signal minimums for the time period. "NEG PK" is read in the active function display area.

(4) Sample Detection mode [SHIFT] [SAMPLE D.] Z

In the Sample Detection mode, the instantaneous signal value of the final analog-to-digital conversion for the time period is displayed. "SAMPLE" is read in the active function display area. When the Averaging mode is selected, the Sample Detection mode is automatically selected.

4-14-4. REF. OFFSET

Any desired offset value can be applied to the reference level of this unit. First press the [SHIFT] and [REF. LEVEL / REF. OFFSET] keys, and then key in the offset value [XX dBm] using the DATA keyboard. If a negative unit offset value is required, press the [Hz −dBm μsec] switch after keying in the numerical value.

The input offset value is displayed constantly in the bottom left hand corner of the screen in the "OFFSET XX dB" format. Subsequent reference level, marker, and display line displays appear with this offset value added (or subtracted if a negative offset).

Offset input is still possible when the reference level is displayed in [dBμ]. In this case, press the [kHz +dBm msec] or [Hz −dBm μsec] switch after keying in the numerical offset value.

Reference level offset is cancelled and the offset value reset to zero by pressing the [SHIFT], [REF. LEVEL / REF. OFFSET], [0], and [kHz +dBm msec] switches.

4-14-5. Electric Field Strength Measurement

1. Connect an antenna to the TR4172 input terminal (50 Ω), noting that the antenna impedance must be 50 Ω. If not, achieve impedance matching by using a matching circuit.
2. Set the center frequency and frequency span.
3. Press [SHIFT] and [dBμV / FREQ. SPAN], to set the level unit to dBμ.
4. Press the [MARKER] switch to obtain a marker output in the screen, and adjust the marker to the frequency spectrum to be measured.
5. The relation between the marker point display level, that is, the TR4172 input terminal voltage ex (dBμV), and the actual electric field strength (dBμV/m), is given by the following expression.

   $$Ex = ex + K$$

   where K is an antenna coefficient (dB)
6. When the ADVANTEST TR1722 half-wavelength dipole antenna is used, the above antenna coefficient K can be corrected for automatically.

   Press [SHIFT] and [dBμV/m ON / VIDEO]. The marker unit is changed to dBμV/m, and the electric field strength Ex corrected for antenna coefficient K can be read directly. Note, however, that this calibration requires that the supplied 5D2W 10 m cable be used. Use of any other cable will result in the introduction of error.
7. If the ADVANTEST TR1711 logarithmic periodic type antenna is used, press the [SHIFT] and [dBμV/m ON / VIDEO] keys. The Ex value will be a value obtained by subtracting 5 from the displayed value in dBμV/m).

   If [SHIFT], [REF. OFFSET / REF. LEVEL], [5], and [Hz / −dBm / μsec] are pressed, an offset of -5 dBm is applied to the reference level. This means that the marker value can be read directly as the Ex (dBμV/m) value. In this case, too, calibration is dependent on the use of the 5D2W 10 m cable supplied. The use of any other cable results in the introduction of error.

⑧ When SHIFT and dBμV/m OFF SINGLE are pressed, the marker electric field strength measurement is cancelled, and the marker unit is made uniform with the reference level.

⑨ If other antennas apart from TR1722 and TR1711 are used, calibrate with the following equation.

$$Ex = (ex + 6) + La - He + Ba$$
$$= ex + K$$

where He (dB) is the effective antenna length,
La (dB) is cable loss,
Ba (dB) is balun loss, and
K (dB) is the calibration coefficient.

The calibration coefficient for half-wavelength dipole antennas is determined from the following equation.

$$K = 20 \log \frac{\pi}{300} F + 6 + La + Ba$$

where F is the reception frequency (MHz)

$$= -33.6 + 20 \log F + La + Ba$$

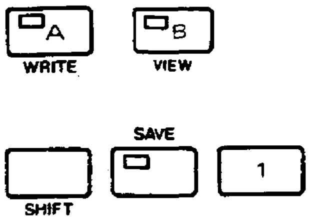
If a wide-band arithmetic periodic type antenna is used, subtract the antenna gain (half-wavelentgh dipole antenna ratio).

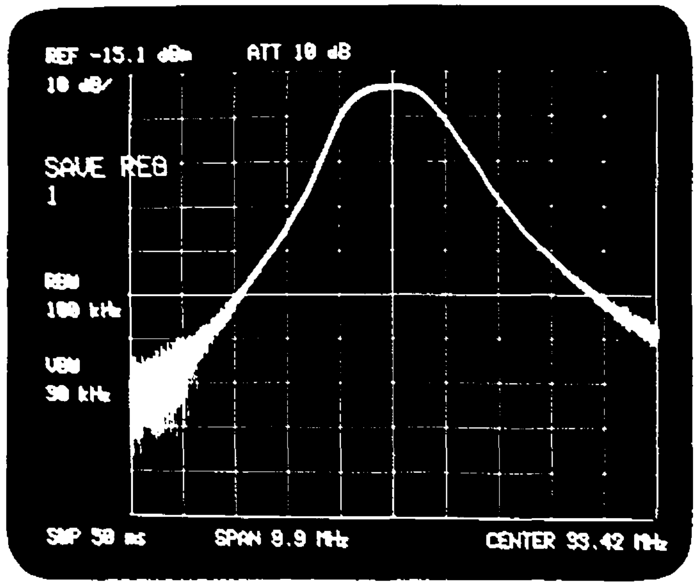
4-14-6. SAVE Register Alternate Sweep-1 SHIFT LABEL MHz dB sec

When SAVE registers 1 and 2, and WRITE A mode and WRITE B mode are used, measurement based on two independently set conditions can be executed alternately, and the results of both measurements can be displayed simultaneously in the screen. The procedure involved is described below. In the examples shown here, the vertical axis scale is set to 10 dB/div. and 2 dB/div.

① With the instrument in the initialized state, press the B VIEW switch to select WRITE A VIEW B mode where the first measuring condition is set. The vertical axis scale in the initialized state is 10 dB/div.
Set the center frequency and the frequency span.

② Press SHIFT, SAVE, and 1 to store the first measuring condition in SAVE register 1.

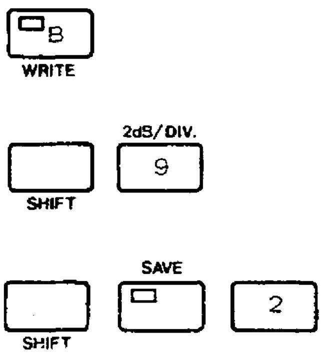


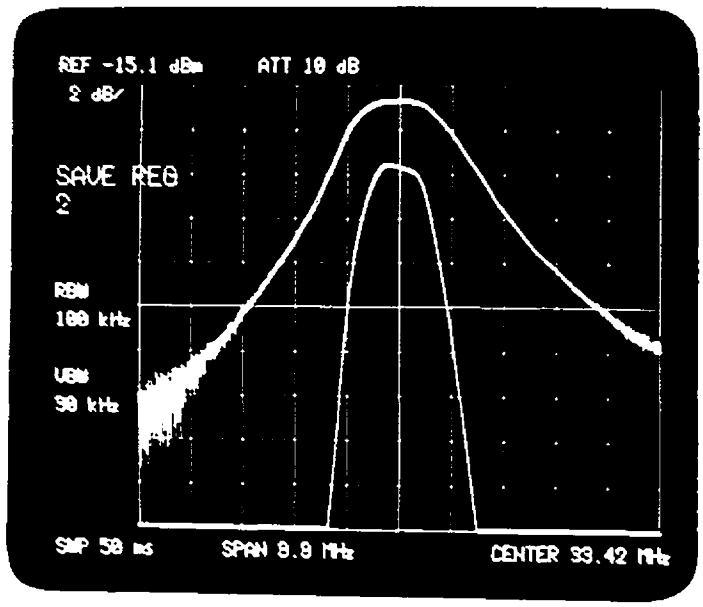


③ Then press the B (WRITE) switch to select WRITE B VIEW A mode. The vertical axis memory is changed to 2 dB/div. by pressing (SHIFT) and 9 (2dB/DIV.).

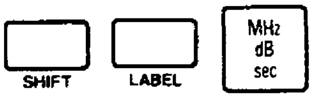
④ Although other measuring conditions can be varied as desired, do not change CENT. FREQ or FREQ. SPAN. If change to either of these functions is desired, refer to the following Save register alternate sweep - 2 procedure.

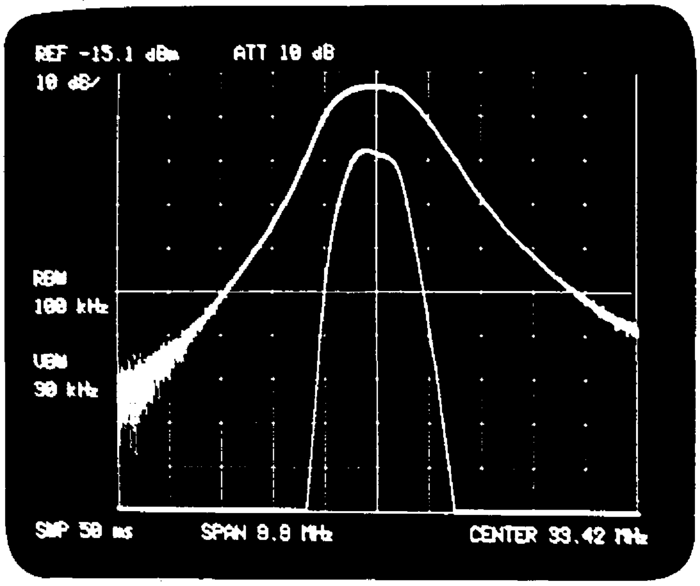
⑤ Press (SHIFT), (SAVE), and 2 to store the second measuring condition in Save register 2.





⑥ The alternate sweep mode is selected by pressing [SHIFT], [LABEL], and [MHz dB sec]. SAVE register 1 [A WRITE] and SAVE register 2 [B WRITE] are recalled alternately at each sweep, and are displayed simultaneously in the screen.
The LED Indicator lamps in the [A WRITE] and [B WRITE] switches come on alternately to indicate the alternate sweep mode.
If a short sweep time is selected, the readouts may be difficult to read because they change at a relatively high rate.
The Alternate sweep mode can be disabled by pressing any key.





4-14-7. SAVE Register Alternate Sweep-2 [SHIFT] [LABEL] [kHz +dBm msec]

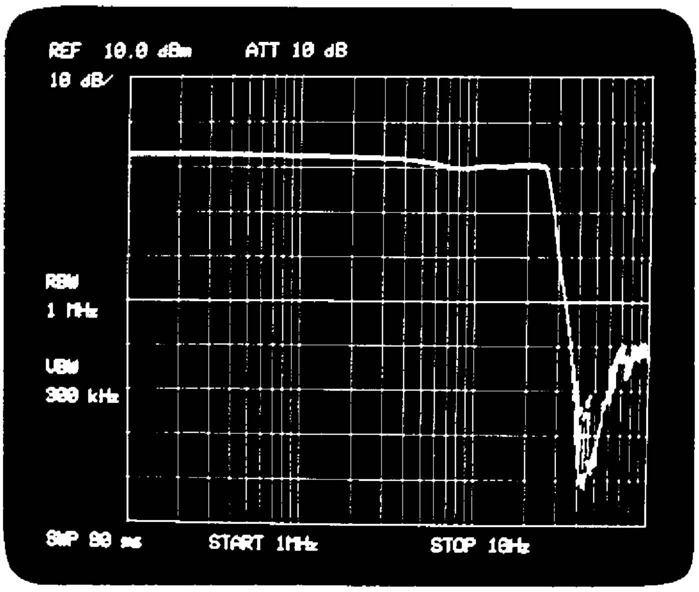
In addition to the functions saved in the SAVE register alternate sweep-1 mode, different center frequency and frequency span data can be saved in SAVE registers 1 and 2 in the SAVE register alternate sweep-2 mode. The required save method is identical to that for the SAVE register alternate sweep-1 mode. In the alternate sweep-2 mode, the display writing rate may be lower than that in the alternate sweep-1 mode.

4-14-8. Logarithmic Scaling for Frequency (Log Display)

After blanking the B and B' traces, pressing [SHIFT] [LABEL] [CENT. FREQ.] places the horizontal graticule in the logarithmic scale. The center frequency and frequency span readouts disappear from the display and, instead, a START frequency (frequency at the left most graticule) and a STOP frequency (frequency at the right most graticule) are read out. The START frequency is selected from 100 Hz, 1 kHz, 10 kHz, 100 kHz, and 1 MHz so that the center frequency on the linear scale is positioned near to the center of the display. Since the frequency span covers three decades, a STOP frequency is 1000 times as large as a START frequency. For instance, when the center frequency is between 100 kHz and 900 kHz, the START and STOP frequencies are 10 kHz and 10 MHz respectively.

The analyzer can be returned to the linear mode by operating any key except the [Δ] key for plotting. (See Section 8-15.)

A log display example is given below.



When observing noise wavefrom, press [SHIFT] [SAMPLE D.] Z to select the sample detection mode before entering the log. display mode. When the RES. BW. key is in the AUTO mode, a constant resolution bandwidth may not be selected over the three decades. To obtain a constant resolution bandwidth over the three decades, press the RES. BW. key to select MANUAL mode and select desired resolution bandwidth in MANUAL mode before entering log. display mode.

Logarithmic scaling trace in memory A can be stored by operating keys [B VIEW] [A⇄B] . If the HOLD key is pressed to return to linear scale mode, information of logarithmic scaling trace except vertical graticule stored in memory B is saved. Press the key [ ] Q when plotting by TR9834R is desired.

4-14-9. Error Correction Routine

The error correction routine is for upgrading of measurement accuracy. This is done by correcting the previously-obtained correction factor at the time of actual measurement, when the routine is executed on TR4172. The following items are measured by the error correction routine using TR4172:

- absolute level error at the time of switching the resolution bandwidth between 7 Hz and 1 MHz
- vertical linearity of the screen for log 10 dB/DIV., 5 dB/DIV., 2 dB/DIV. and 1 dB/DIV.

Set the POWER switch ON and warm up for more than one hour. Attach the N-BNC adapter to the INPUT-1 connector and TRACKING GENERATOR OUTPUT connector and then interconnect both connectors with the attached input cable MI-02. Pressing [SHIFT] [LABEL] [ ] W activates the error correction routine to measure log linearity first with "CALIBRATING LOG LINEARITY" displayed on the screen.

The following message will appear if neither connectors are connected:

PLEASE CONNECT T.G. OUTPUT TO INPUT-1

CONTINUE OR QUIT < 0 OR 1 >

Error correction is possible if key [0], from the ten keys, is pressed after making proper connection between two connectors with MI-02. Pressing key [1] here will result in normal condition.

The following message will displayed on the screen when log linearity measurement is completed:

PLEASE CONNECT CAL.OUT. TO INPUT-1

AND PUSH ANY KEY

When the above message is displayed, remove the cable which connects the TRACKING GENERATOR OUTPUT connector and INPUT-1 connector and interconnect the CAL.OUT.connector and INPUT-1 connector with the attached cable MC-61.

The measurement of absolute level errors at the time of resolution bandwidth switching will start if an arbitrary key is pressed with "CALIBRATING SWITCHING BETWEEN" displayed after completing the above operation.

When all error corrections are completed, the display at the left center on the screen disappears and the state before entering into the error correction routine is recovered.

The user can display a list of corrected values of resolution bandwidth which were stored in the memory by pressing [ ] [ ] [ ] X.

SHIFT LABEL

Confirm that all values fall with in a range of ± 3 dB. Normal display is recovered by pressing an arbitrary key.

When corrected values exceed a range of ± 3 dB, adjust by turning the CAL control knob - a fine adjustment control knob for IF gain - on the front panel. Turning the knob clockwise will decrease the level on the screen while turning counterclockwise will increase it.

After this adjustment, execute the error correction routine again to confirm, on the displayed, list that all the corrected values fall within a rage of ± 3 dB. The corrected values once stored into the memory cannot be erased by pressing MASTER RESET key or by setting POWER switch to STANDBY. The stored values are retained for approx. two weeks with the aid of built-in Ni-Cd cells even if the power cable is disconnected.

When measurement without the calibrated values is required, press [ ] [ ] [ ] Y, and the following message will be dispalyed:

SHIFT LABEL

CAL. ON NOW

'1' CAL. ON

'2' CAL. OFF

Error correction will not be made if key [2], from the ten keys, is pressed. Pressing key [1], from the ten keys, will result in the error correction mode in which the previously obtained factors will be used.

4-15. QP Measurement Mode

4-15-1. Outline

QP measurement mode is used to measure impulsive noise. As indicated in Table 4-2, the various constants used in the measurement comply with the values prescribed by CISPR standards.

Table 4-2 CISPR standards concerning basic QP measurement characteristics

	Frequency range	6 dB BW	Charging time constant	Discharging time constant	Mechanical time constant
A	10 kHz to 150 kHz	200 Hz	45 ms	500 ms	160 ms
B	150 kHz to 30 MHz	9 kHz	1 ms	160 ms	160 ms
C	30 MHz to 300 MHz	120 kHz	1 ms	550 ms	100 ms
D	300 MHz to 1 GHz	120 kHz	1 ms	550 ms	100 ms

4-15-2. QP value measurement

1. Set the center frequency and the desired frequency span.
2. Press and increase or decrease input attenuation with the DATA knob or step keys, 10 dB at a time, while observing the waveform on display.
3. Check that the waveform level does not vary. If it varies, input to the TR4172 is saturated. To avoid saturation, increase input attenuation or insert a bandpass filter or equivalent in the input circuit.
4. If no variations in the waveform level have been verified, change the reference level with REF. LEVEL to set the output peak level 20 dB to 30 dB down from the top of the screen before entering a QP measurement mode listed in Table 4-3.

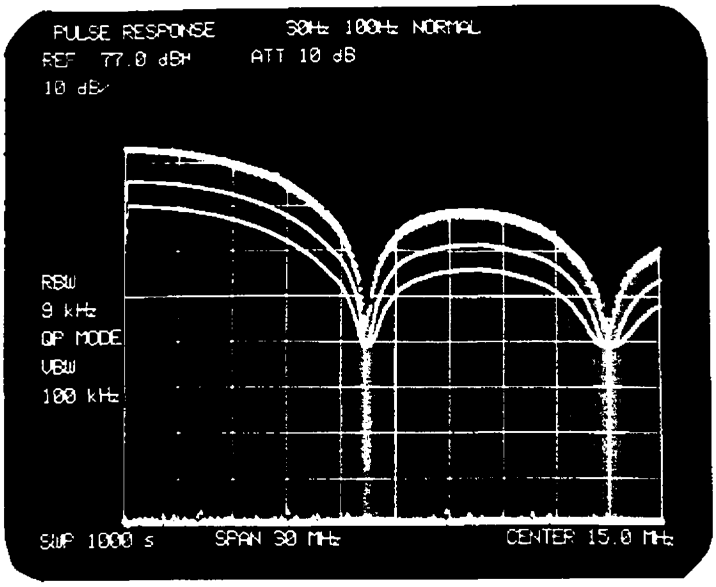
Table 4-3 QP measurement modes

Frequency range		6 dB BW	QP measurement
A	10 kHz to 150 kHz	200 Hz	SHIFT LABEL j
B	150 kHz to 30 MHz	9 kHz	SHIFT LABEL k
C,D	30 MHz to 1 GHz	120 kHz	SHIFT LABEL m
To cancel QP measurement mode,			SHIFT LABEL z

(5) QP measurement involves the use of long time-constant circuits as shown in Table 4-2, requiring sufficiently long sweep time settings. As a general rule, set a sweep time of 1 second/200 Hz in frequency range A (10 kHz to 150 kHz), to 1 second/10 kHz in frequency range B (150 kHz to 300 MHz), and to 1 second/100 kHz in frequency ranges C and D (30 MHz to 1 GHz).

For example, the sweep time should be set to 50 seconds if measuring in a frequency range with a frequency span of 10 kHz.

(6) After setting the sweep time, press the MARKER switch to output a marker. The level at the marker point is represented in dBμ, indicating the QP value of the input terminal at the marker-point frequency.



⑦ Press [SHIFT], [dBμV/m ON] when a ADVANTEST TR1722 half-wavelength dipole antenna is used.
This key-in sequence automatically corrects the antenna coefficient to represent the marker point level in dBμV/m, permitting the QP value to be read directly.

⑧ With a ADVANTEST TR1711 logarithmic-period antenna, press [SHIFT] [dBμV/m ON] [SHIFT] [REF. LEVEL (REF. OFFSET)] [5] [Hz −dBm μsec] to enter an offset of −5 dB in the reference level.
Again, the antenna coefficient is automatically corrected, enabling direct reading of the QP value. (It is displayed in dBμ.)

⑨ The automatic correction for the TR1722 and TR1711 antennas assumes the use of the supplied 10m 5D2W cable.
Use of any other cable might produce an error in antenna coefficient correction.

⑩ If a different antenna is used, calculate the QP value by determining the correction coefficient with reference to 4-14-5. "Electric field strength measurement."

⑪ To cancel the QP measurement mode, press [SHIFT] [LABEL] [AUTO] z.

4-15-3. QP BW Check

6 dB BW (bandwidth) of CISPR standards listed in Table 4-2 can be verified by following the procedures given below.

① Connect the CAL. OUT signal to the INPUT-1 connector of RF section, and set the center frequency to 50 MHz by operating keys [CENT. FREQ.] [5] [0] [MHz dB sec] .

② Set the frequency span, depending on which of frequency ranges A to D has been set, as indicated in Table 4-4.

Table 4-4 QP BW check

Frequency range		6dB BW	Frequency span	QP BW check mode
A	10 kHz to 150 kHz	200 Hz	2 kHz	[SHIFT] [LABEL] [ ]M
B	150 kHz to 30 MHz	9 kHz	10 kHz	[SHIFT] [LABEL] [ ]N
C, D	30 MHz to 1 GHz	120 kHz	1 MHz	[SHIFT] [LABEL] [▭]O
To cancel QP BW check mode, [SHIFT] [LABEL] [AUTO]Z				

After entering the frequency span, execute one of the QP BW check modes, depending on which of frequency ranges A to D has been set, as indicated in Table 4-4.

③ Freeze the spectrum by pressing [▭A VIEW] key, and then press [⊿] key and use the DATA knob to check 6 dB bandwidth.

Specifications are as shown below.

A) 200 Hz ± 20 Hz

B) 9 kHz ± 1 kHz

C, D) 120 kHz ± 20 kHz

4-16. X-Y RECORDER OUTPUT (OPTION 03)

This optional output provides signal response and graticule information (display line and markers are not included) to an X-Y recorder. The information on the display is subject to digital-to-analog conversion and coupled to the X, Y, and Z connectors on the rear of the instrument in the form of analog signals. The usage of this optional output is explained in the following:

First, connect the TR4172's rear X, Y, and Z connectors to the X, Y, and Z inputs on the X-Y recorder respectively.

Each output has an output voltage range of 0 V to approximately +5 V. The Z output provides pen up/down control: 0 V for pen up, and approximately +5 V for pen down. While the initial default setting for the Z output for pen lift control is 0 V for pen up and approximately +5 V for pen down, this condition can be reversed by key operation. If the Z output does not match the specification of the X-Y recorder used, use the Pen Lift switch on the recorder for pen up/down control.

The necessary key operations for the optional output are described below:

(1) X-Y recorder output mode

Press [ ] [ ] [2] to select the X-Y recorder output mode.
SHIFT LABEL
Message "X-Y RECORDER" will be shown in the active function display area of the screen. In this mode each front panel key has functions different from those used for normal measurement. To clear the X-Y recorder mode, press the SHIFT key.

(2) Setting the image size and position

To set up the size and position of the output image on the X-Y recorder, press the [⇩] key. This will lift the recorder's pen and move it to the lower left home position. Message "LOWER LEFT" will be shown in the active function display area of the screen. Operation of the [⇧] key lifts the pen and moves it to the upper right home position. Message "UPPER RIGHT" will be shown in the

active function display area of the screen.
Determine the size and position of the output image on the recorder by adjusting the gain and offset of the recorder while operating these two keys.

(3) All trace and scale output

Operation of the A WRITE key causes the X-Y recorder to record all traces (traces A, A', B and B') and graticule. After recording one trace, the recorder's pen lifts, returns to the lower left home position, and then starts recording the next trace or graticule. If the Z output (pen lift signal) of the TR4172 does not match the X-Y recorder specification, pen lift operation will not be done automatically. In this case, use (4) through (8) below, and manually lift the pen at the end of each trace output, press the ⇩ key to return the pen to the lower left home position, then lower the pen again before starting output of another trace or graticule.

(4) Output of only the graticule

Press the B WRITE key to output only the graticule.

(5) Trace A output

Press the A VIEW key to output trace A.

(6) Trace B output

Press the B VIEW key to output trace B.

(7) Trace A' output

Press the A' VIEW key to output trace A'.

(8) Trace B' output

Press the B' VIEW key to output trace B'.

(9) Holding recorder operation

If the HOLD key is pressed, the X-Y recorder temporarily suspends

its operation with its pen lifted up. A second operation of the [HOLD] key restarts recorder operation from the hold point. If other trace key (e.g. [WRITE A] key) is pressed when the pen remains stationary, the pen will automatically return to the lower left home position and then start output of the trace selected with the trace key.

(10) Clearing the X-Y recorder output mode

To clear the X-Y recorder output mode, press the [SHIFT] key.

(11) Recording speed selection

The frequency axis of the TR4172 usually consists of 1001 data points. Each of these points is subject to digital-to-analog conversion at approximately 100 ms sampling rate for the optional X-Y recorder output. This sampling rate can be varied between approximately 10 ms and 1000 ms with the [SWEEP TIME] key and DATA knob used together.

Operation of the [SWEEP TIME] key will show the current sampling rate "100 ms/POINT" in the active function display area of the screen. Use the DATA knob to change this active readout of sampling rate to the desired rate.

This newly specified sampling rate will be cleared into 100 ms/POINT and its readout will disappear from the active function display area when the X-Y recorder output mode is cleared with the SHIFT key operation.

(12) Pen up/down control setting

If the Z output of the TR4172 properly matches the pen control input of the attached X-Y recorder, operation of [RES. BW] j key will lift the pen, and operaiton of [AUTO] p will lower it. If the actual pen movement is the reverse of the above, reverse the polarity of the Z output according to the following instructions:

(13) Z ouput polarity reversal

If [VIDEO BW] k key is pressed, the Z output provides 0.0 V for pen-up and approximately +0.5 V for pen-down. At this time the message

"PEN UP/DOWN = LO/HI" is shown in the left information area on the display.

If AUTO key is pressed, the Z output provides approximately +5.0 V for pen-up and 0.0 V for pen-down. At this time the "PEN UP /DOWN = HI/LO" is shown in the left informatuon area on the display.

4-17. WRITING UPPER AND LOWER LIMIT DATA

Upper and lower limit data can be written on the TR4172's screen directly from its front panel. This allows the operator to know whether the signal response trace in question falls within the limits or not at a glance (see Figure 4-1).

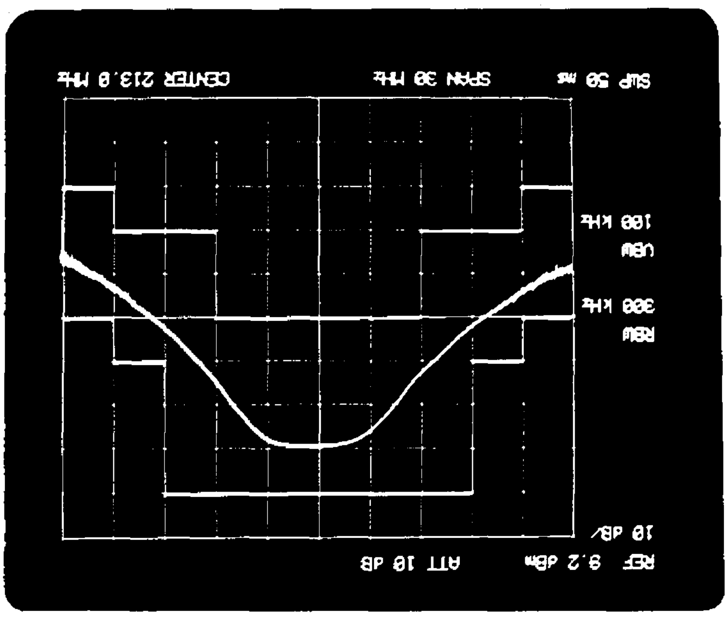


Fig. 4-1 Signal response observation with upper and lower limit data written on the screen

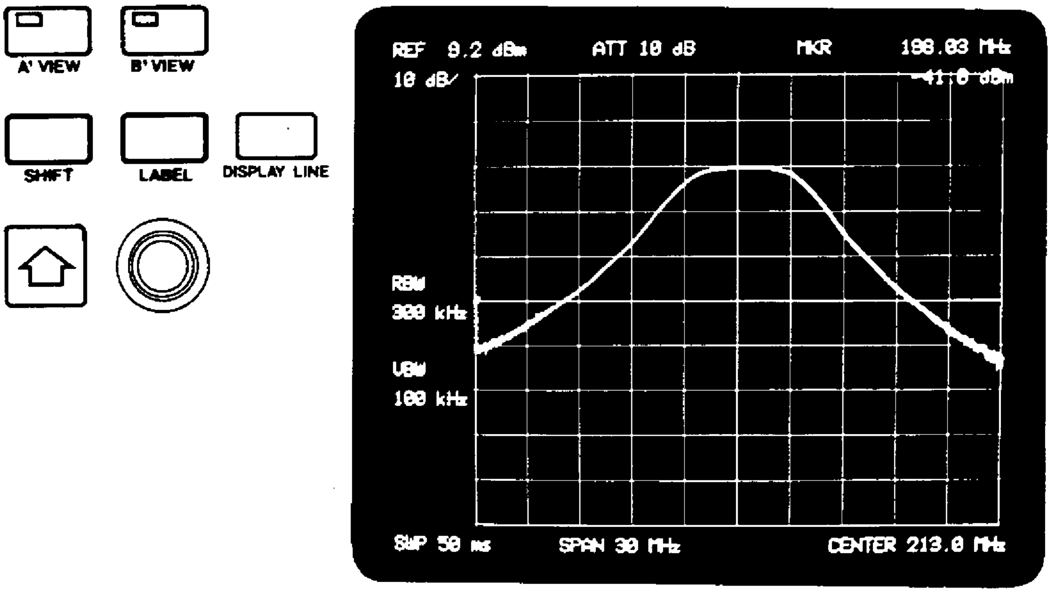
First write upper (or lower) limit data into memory A, then transfer the data to memory A'. Next, write lower (or upper) limit data into memory A, then place the analyzer in WRITE B mode for signal observation. More detailed procedure is described in the following:

(1) Press the VIEW A key. Place memory B into VIEW B or BLANK B mode.

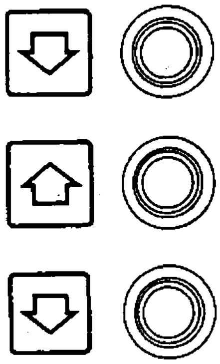
(2) Press SHIFT LABEL DISPLAY LINE keys. This will present an active marker at the bottom left corner of the screen.

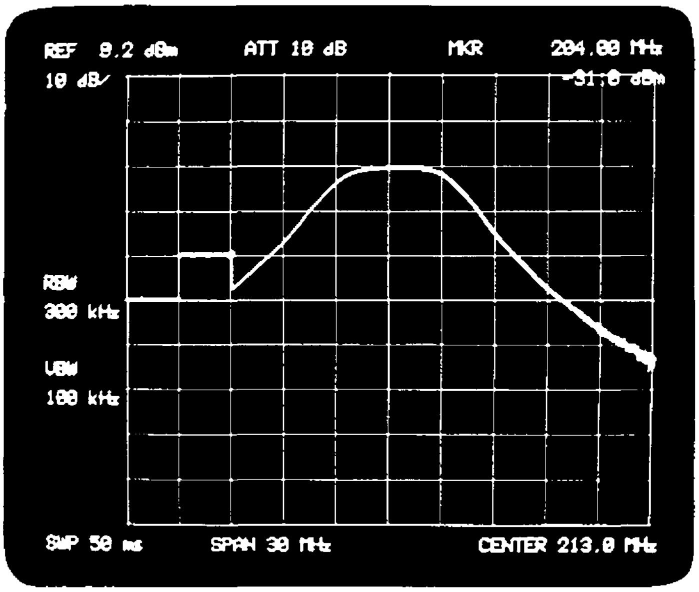
(3) Operation of or key will enter the upper or lower limit data write mode.

(4) If key is pressed, rotation of the DATA knob moves the marker in the vertical direction: clockwise operation of the knob moves the marker upward, and counterclockwise operation of the knob moves it downward.



(5) If key is pressed, operation of the DATA knob moves the marker in the horizontal direction to enable upper or lower limit data writing. Subsequently use or key to write the desired upper (or lower) limit data on the screen.





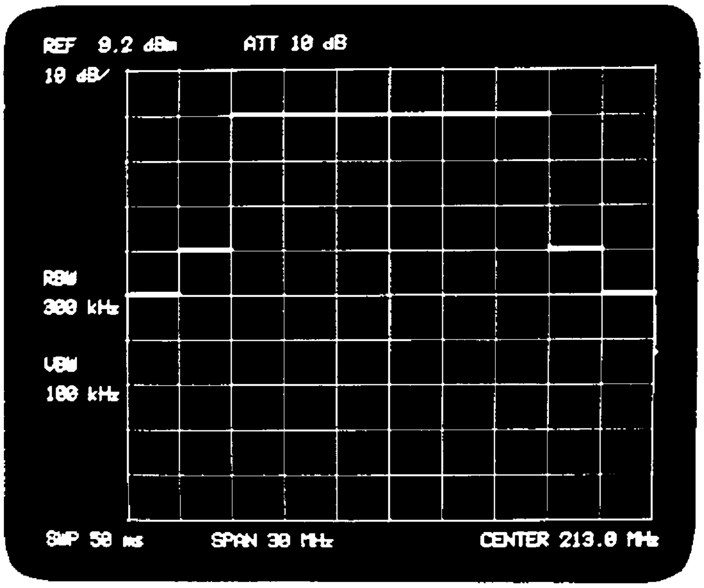
⑥ While upper or lower limit data is being written, the frequency and level at the marker are read out at the top right corner of the screen.

⑦ If the DATA knob is operated after  BACK SPACE key is pressed, limit data writing will not occur, and the marker simply moves along the upper or lower limit trace already written on the screen.

Operation of  or  key will again enter the limit data write mode.

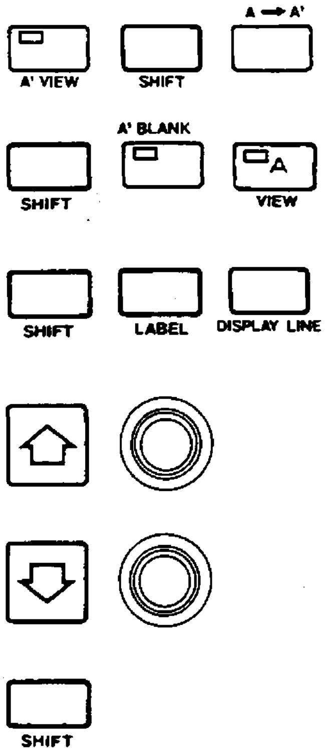
⑧ When all upper (or lower) limit data is written, press the SHIFT key. This will erase the marker from the screen and place the analyzer into the normal measurement mode.

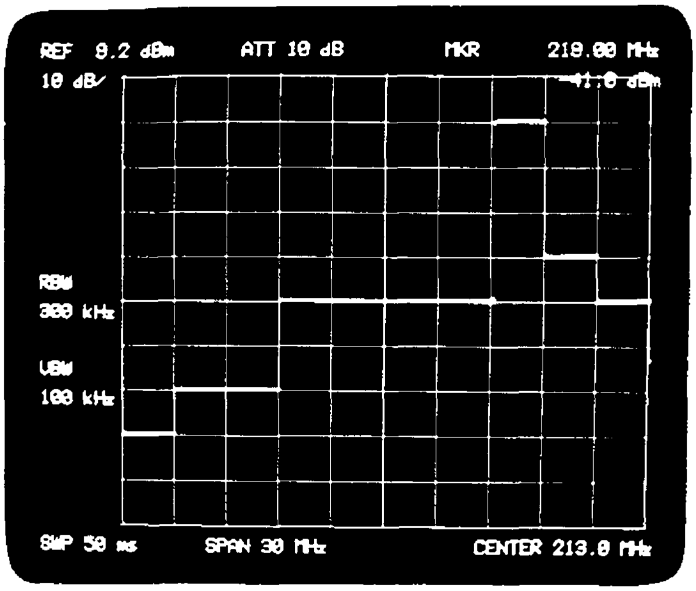
[SHIFT]



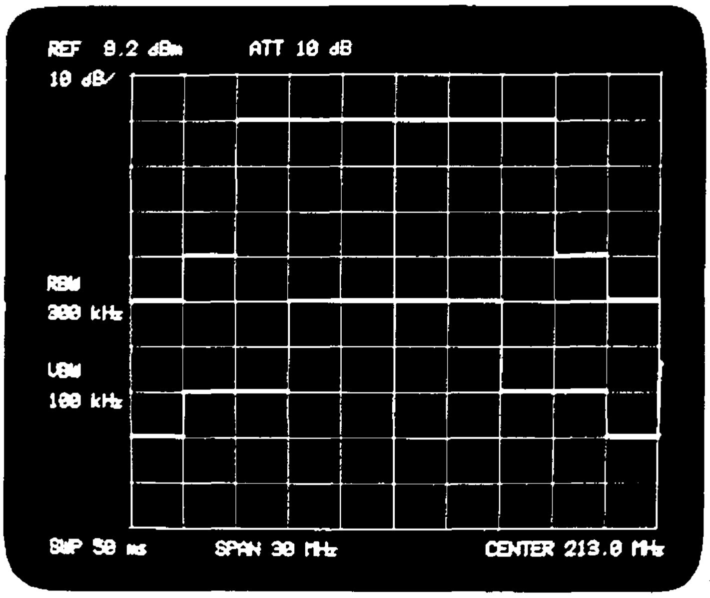
⑨ When subsequently writing lower (or upper) limit data as well, proceed with following steps ⑩ and ⑪. If not, proceed with step ⑫.

⑩ When writing lower (or upper) limit data following upper (or lower) limit data writing, press [A' VIEW] [SHIFT] [A → A'] [SHIFT] [A' BLANK] and [A VIEW] keys, then press [SHIFT] [LABEL] and [DISPLAY LINE] key to present and active marker. Then follow the procedure given in above steps ③ through ⑦ to write lower (or upper) limit data directly on the screen.

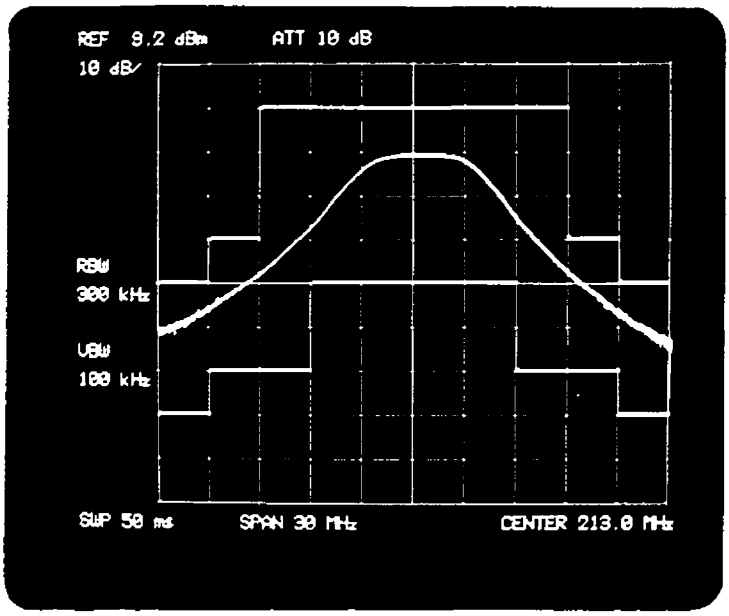




⑪ When all lower (or upper) limit data is written into memory A, press the SHIFT key to erase the marker from the screen, then press the VIEW A' key. This will show the lower and upper limit traces each stored in memories A and A', on the display.



(12) Press the WRITE B key and observe the signal response of the DUT.



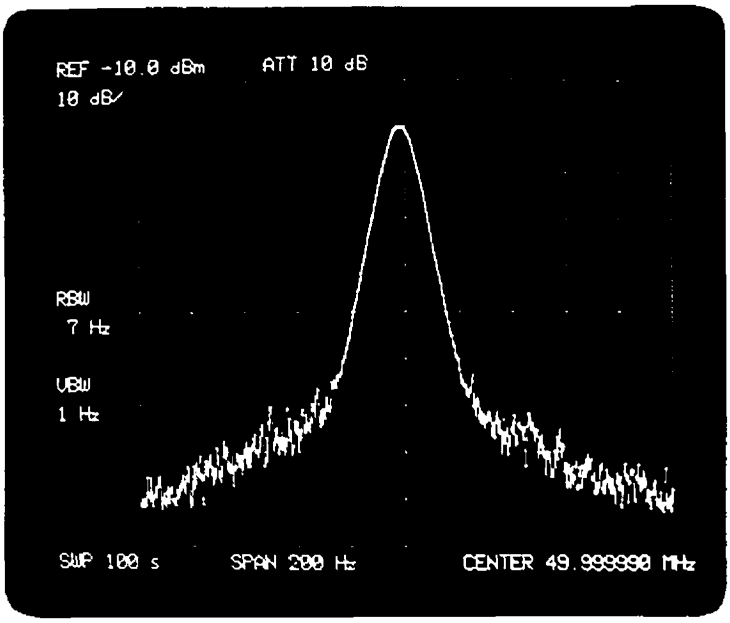
(13) Operation of the WRITE A key erases the lower (or upper) limit data from memory A. Operation of [SHIFT] [A' BLANK] keys erases the upper (or lower) limit data from display, but memory content remains. Therefore, operation of VIEW A' key displays the upper (or lower) limit again.

4-18. SWEEP RESET

Operation of [SHIFT] [LABEL] [SWEEP TIME]d keys resets sweep to cause it to restart from the leftmost graticule.

4-19. RES. BW 7 Hz

Operation of [SHIFT] [LABEL] [AUTO]p keys sets resolution bandwidth (RES. BW) to 7 Hz. In this case, however, data will not be guaranteed as the bandwidth accuracy is outside the specification.



4-20. CENTER FREQUENCY REPOSITIONING (DRIFT CANCEL)

(1) On the TR4172, center frequency is repositioned for each sweep when the following center frequency and frequency span are selected, so as to prevent frequency drift:
Center frequency: 1500 MHz or below and
Frequency span: 10 MHz to 510 kHz, or 10 kHz or below

(2) To clear the center frequency repositioning mode for faster screen rewriting, press SHIFT LABEL 5 keys. Center frequency repositioning will subsequently not occur (Drift cancel OFF). The center frequency repositioning mode will be restored by operating SHIFT LABEL 4 keys or MASTER RESET key. (Drift cancel ON)

(3) If the center frequency repositioning mode is desired for a center frequency and frequency span other than those given above, operate SHIFT LABEL 4 keys. The center frequency will be repositioned for each sweep. If, at this time, the CENT. FREQ., FREQ. SPAN, or MASTER RESET key is pressed, the analyzer returns into the original center-frequency repositioning mode, in which center frequency repositioning occurs only for the center frequency and frequency span ranges specified in above item (1).

4-21. OCCUPIED BANDWIDTH DISPLAY

Occupied bandwidth display performs necessary operations to determine the occupied bandwidth from the displayed data on the TR4172. The operations are performed as follows:

There are 1001 points of data on the frequency axis of the TR4172's display. If the voltage of one of the points is assumed to be Vn, the total power P of the signal response on the display is determined by:

$$P = \sum_{n=1}^{1001} \frac{Vn^2}{R} \qquad \text{(R: TR4172's input impedance)}$$

If the sum of the power between the first (leftmost) and X'th points on the frequency axis is 0.5% of P, then we obtain:

$$0.005P = \sum_{n=1}^{X} \frac{Vn^2}{R}$$

If the sum of the power between the first (leftmost) and Y'th points on the frequency axis is 99.5% of P, we obtain:

$$0.995P = \sum_{n=1}^{Y} \frac{Vn^2}{R}$$

We determine X and Y from the above three equations, then determine the occupied bandwidth (OBW) from the following equation along with frequency span f_{SPAN}:

$$OBW = \frac{f_{SPAN}\,(Y - X)}{1001}$$

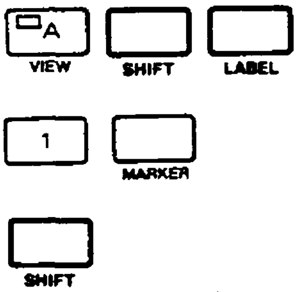
The OBW display procedure is described below.

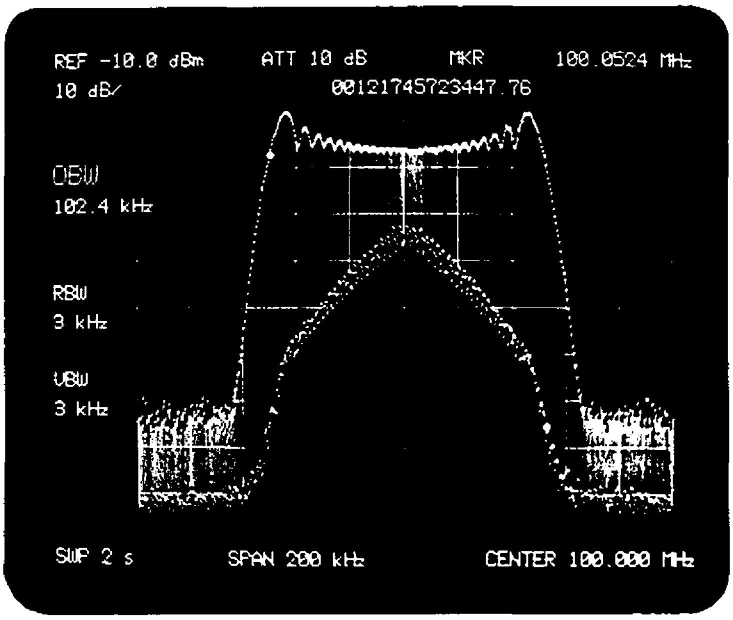
1. Select the WRITE A mode and display the desired signal response trace in the center of the screen. Set the vertical scale to 10 dB/div. and leave all marker inactive.
2. Press the VIEW A key to hold the display, then press [SHIFT] [LABEL] [1]. The occupied bandwidth operation will be initiated. Upon the end of the operation, two markers will appear at points X and Y mentioned above to indicate the calculated occupied bandwidth.

(3) Operation of the MARKER key will display the occupied bandwidth readout at the top left corner of the screen together with indicator "OBW". The marker frequency readout at the top right corner of the display shows the frequency at the right-hand side marker.

(4) To obtain the relative value readout of the total spectrum power, P (1×10^3 to 1.7×10^{13}), in the top display area of the screen, press the SHIFT key.

(5) If the MKR OFF key is pressed, the display and readouts pertaining to occupied bandwidth disappear from the display and the TR4172 returns to the normal measurement mode.



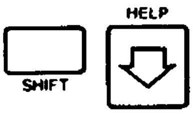


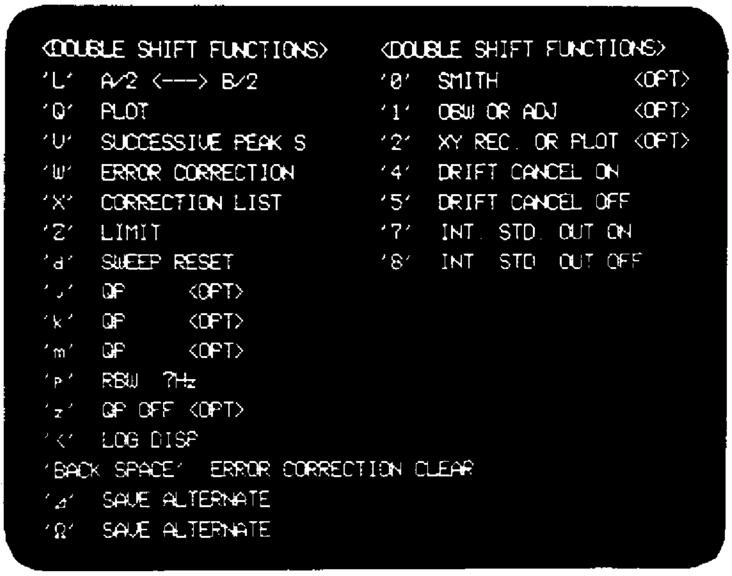
(6) Occupied bandwidth data can be obtained with less error by setting resolution bandwidth to 1/200 of the frequency span or less. And maximum value or average value of the occupied bandwidth can also be measured by using MAX. or AVG. mode concurrently.

4-22. HELP MODE

No specific panel inscription or indicator is provided for the double shift function for which a specific key is pressed after SHIFT and LABEL keys are operated.

Operation of SHIFT HELP selects the HELP mode, in which the display provides a listing of the above double shift key functions on the screen. Note that when the instrument is set up in the state in which only the specific key operation can be entered in the mode such as ALTERNATE SWEEP or LOG. DISPLAY, the HELP mode cannot be activated.
Reset the mode to the normal measurement mode to activate the HELP mode.





Pressing HOLD (U) or BACK SPACE key clears the list and the analyzer returns to the normal condition.
Appendix A-1 lists the pages containing descriptions of each double shift function.

4-23. MEASURING ADJACENT NOISE LEVEL OF OSCILLATION BY AVERAGING

This paragraph describes how to measure the adjacent noise level for 50 MHz oscillation by using the averaging feature (Section 4-14-1). The adjacent noise analysis range is assumed to be ±50 kHz of the oscillation frequency.

1. Connect the output of a 50 MHz oscillator to INPUT-1 on the TR4172 as shown in Figure 4-2.

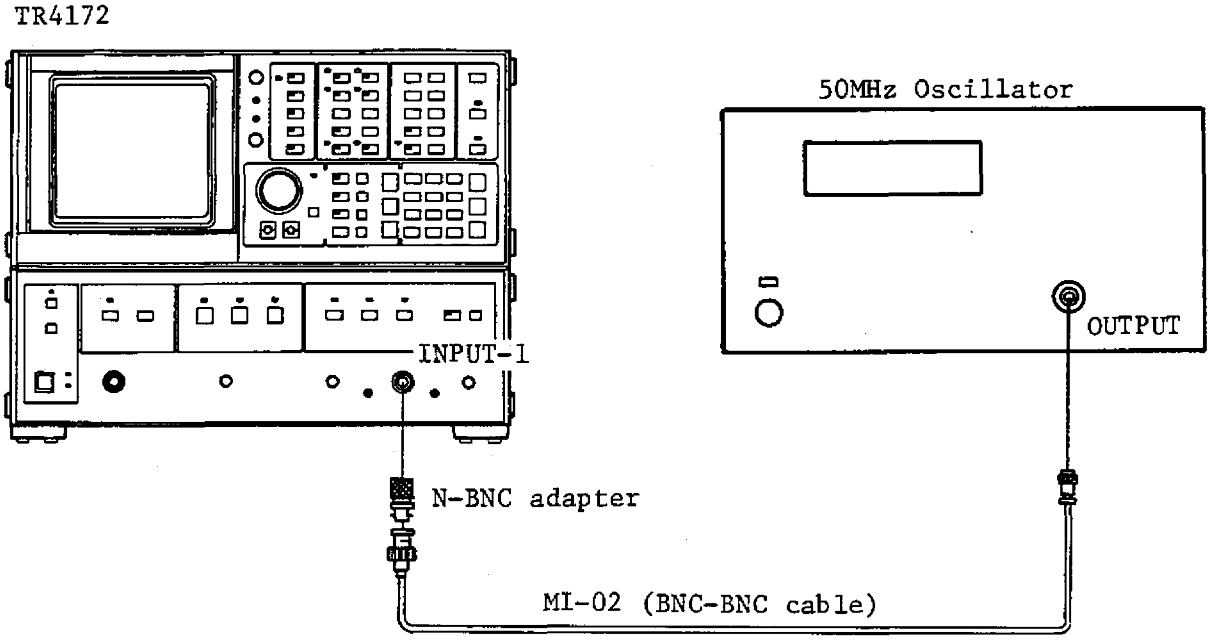


Fig. 4-2 Measurement setup

NOTE

1) When the oscillator output is directly coupled to the TR4172 input, the output frequency may be subject to change due to the input capacitance of the TR4172. If this occurs, use a probe with a smaller cable capacitance for the input connection.
2) The maximum allowable input level to the TR4172 is +20 dBm when the input attenuator is set at 20 dB or greater.
   Be careful not to apply an input level exceeding +20 dBm. Use an external attenuator if necessary.

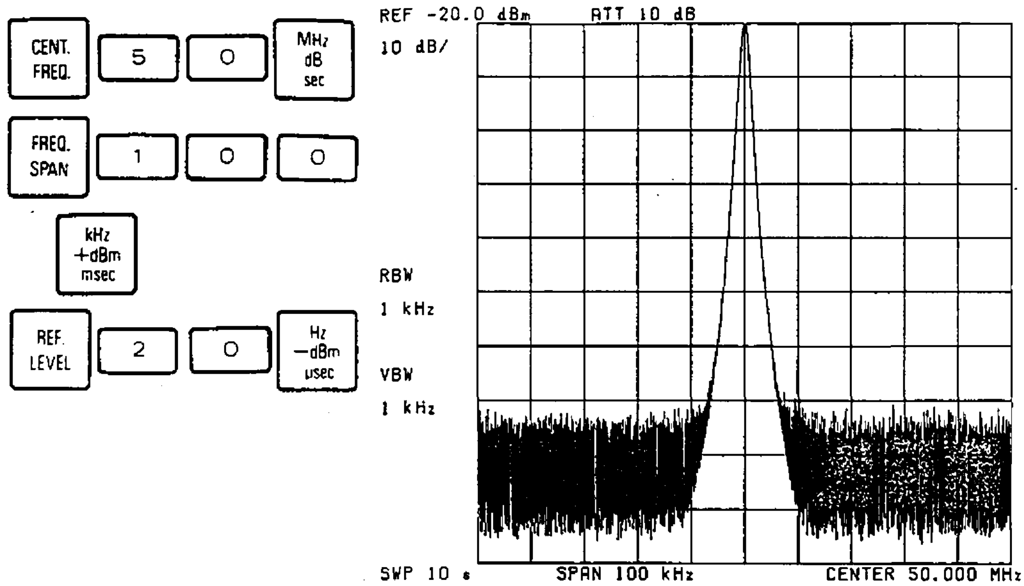
(2) While the TR4172 is in the initial default state (immediately after MASTER RESET key operation), prepare it as follows:

(a) Set the center frequency to 50 MHz.

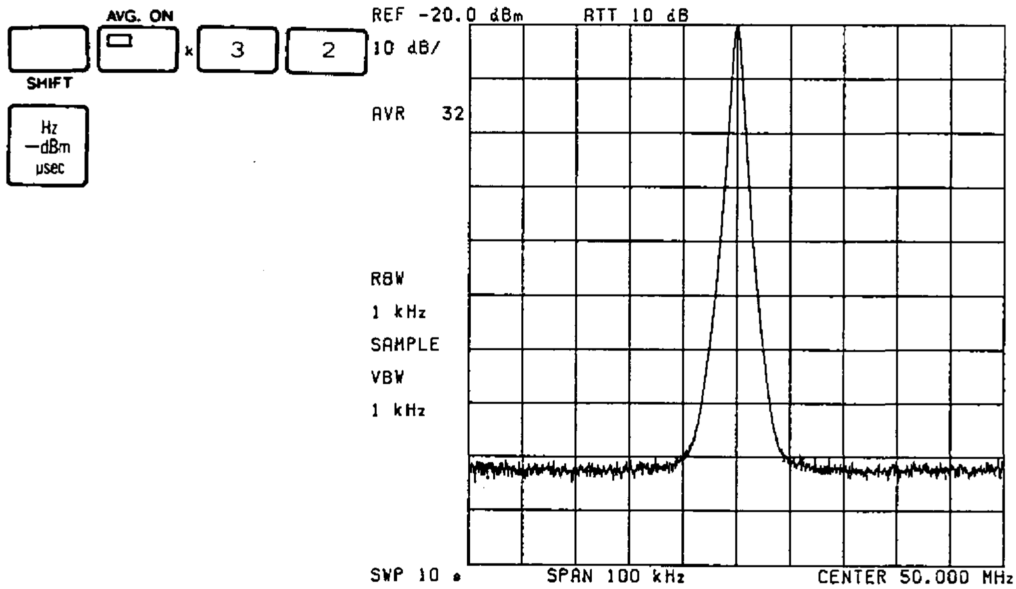
(b) Set the center frequency span to 100 kHz to accommodate the analysis range of ±50 kHz.

(c) Set the reference level. For example, if the input signal level is -20 dBm, set the reference level to -20 dBm.

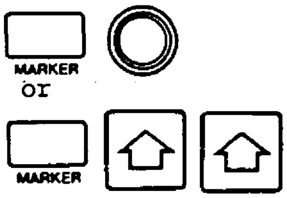
(d) The sweep span, resolution bandwidth, video bandwidth, and so forth are automatically set to the optimum values according to the selected frequency span, since the AUTO mode is in the initial default selection. If, for example, desire manual selection for those parameters, press [RES. BW] [1] [kHz +dBm msec] to set resolution bandwidth to 1 kHz. Once the manual mode is selected for a parameter, the lamp in the relevant parameter key comes, on. In this case, the resolution bandwidth is fixed to 1 kHz. Note that the resolution bandwidth remains at 1 kHz if the frequency span is subsequently changed.

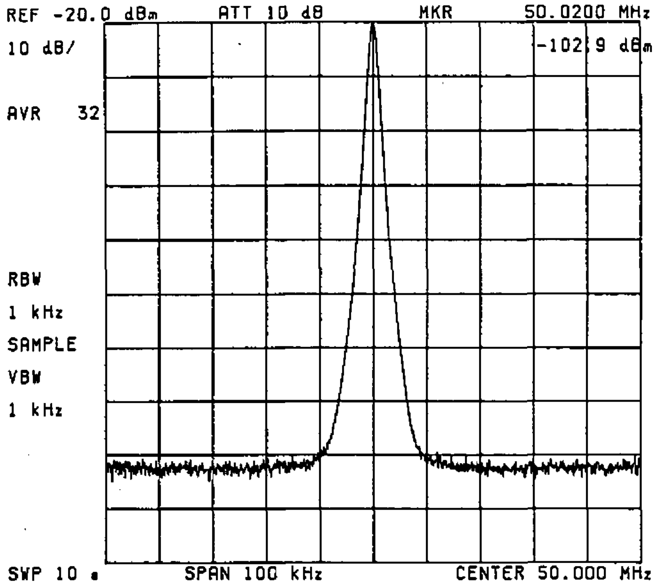


③ Repeat averaging 32 times



(4) Activate a marker and measure the adjacent noise level (for example 20 kHz apart from the signal response).





The marker will move one horizontal division on the scale each time the stop key is pressed. In this example, operating the step key twice.

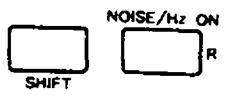
PEAK SEARCH captures the maximum peak of the displayed signal response trace.

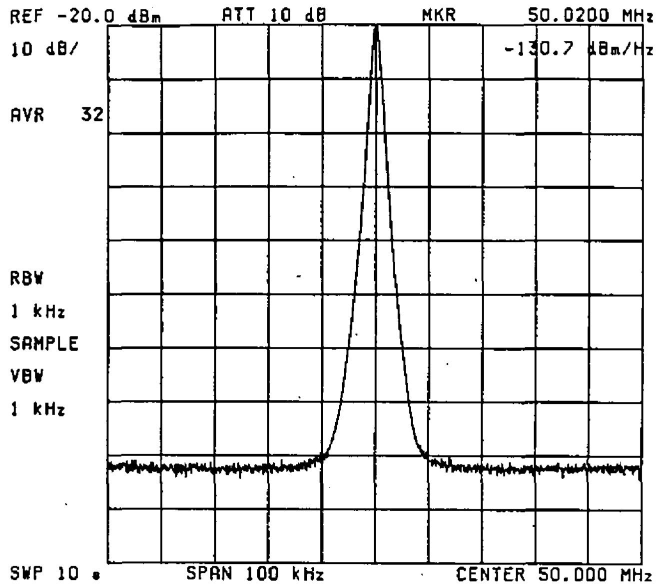
MKR→REF. positions the reference level at the level identified by the marker (disabled during averaging).

MKR→CF specifies the frequency identified by the marker as the center frequency (disabled during averaging.)

SHIFT NEG. PEAK S. captures the minimum level of the displayed signal response trace.

(5) If you wish to measure adjacent noise level (noise/Hz), press SHIFT NOISE/Hz ON . This provides for bandwidth conversion for an ideal filter and level compensation for the logarithmic amplifier by the internal CPU, thereby permitting precise measurement.
To return to the normal measurement mode, press SHIFT NOISE/Hz OFF .





4-24. EVALUATION FOR TR4172'S DYNAMIC RANGE BY TWO-SIGNAL RESPONSE

This paragraph shows an evaluation example for the TR4172's dynamic range based on its two-signal response (intermodulation distortion characteristic between the fundamental signal and the 3rd harmonic).

1. Connect the outputs of two signal generators to the input of the TR4172 via a two-signal measuring pad (two-signal branching unit) (See Figure 4-3). When setting the SG output level, the insertion loss (approximately 6 dB) of the branching unit should be taken into account. If you set the outputs of the two SGs at the same frequency, note the maximum allowable input level of the TR4172 (+20 dBm).

   It will help if you have prior information about the signal-to-noise and carrier-to-noise ratios of the two signal generators used.

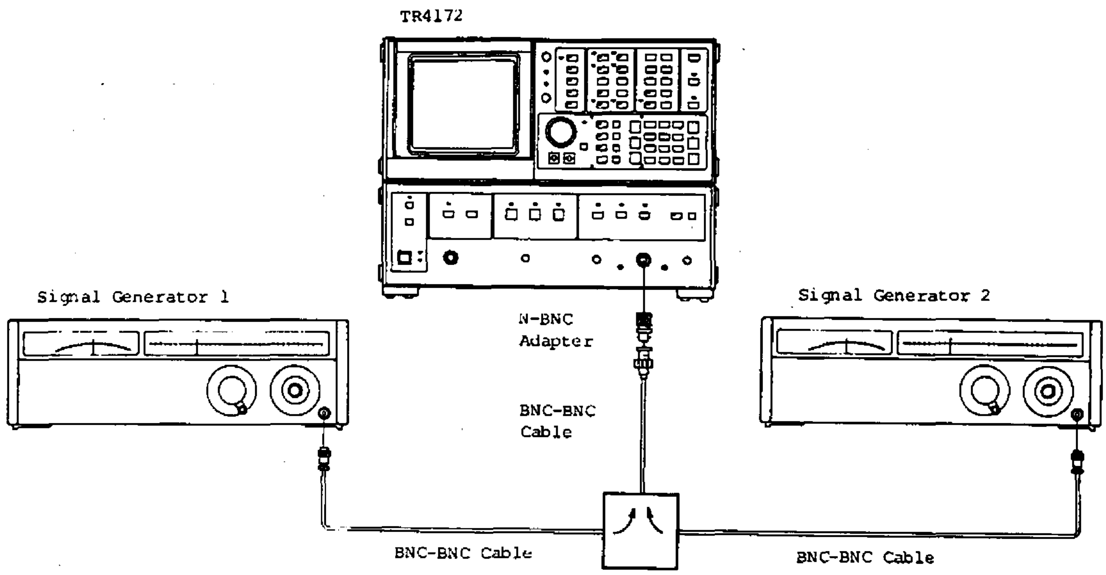


Fig. 4-3 Measurement setup

② Set up signal generator output frequencies. In this example, signal generators A and B are set up respectively for 91 MHz and 92 MHz.

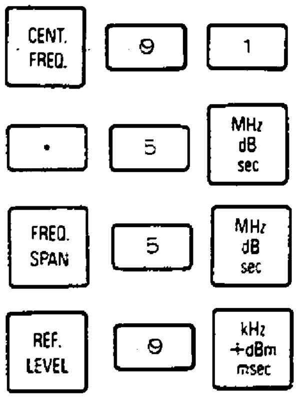
③ With the TR4172 in the initial default state, prepare it as follows:
Center frequency: 91.5 MHz (middle of the two SG output frequencies)
Frequency span: 5 MHz
Reference level: 0 dBm

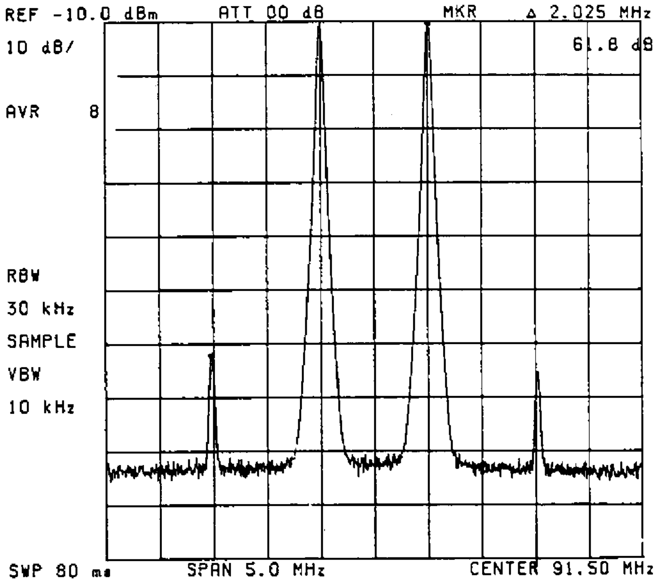
④ If the noise level is too high, manually narrow resolution bandwidth (initially set at the AUTO mode). Note, however, that a resolution bandwidth set too narrow will make the sweep time too long.

⑤ Execute averaging if needed. When executing averaging, select a number of averaging repetitions (such as 8 or 16) fewer than the initial averaging number setup of 128 because this number will make analysis time too long.

[SHIFT] [AVG. ON] [8] [Hz/-dBm/μsec] (Initiates 8 repetitions of averaging sequence.)

(6) The TR4172 has a display dynamic range of 95 dB. Adjust the reference level (while reducing the SG output levels) to search for the maximum sensitivity. If necessary, adjust the input attenuator as well.





(7) Read the difference between the input level and distortion level with the delta marker (see Figure 4-4).
The two-signal characteristic represents the intermodulation distortion between the fundamental wave and the 3rd harmonic. It implies the anti-saturation characteristics of the mixers or amplifiers used in the spectrum analyzer.

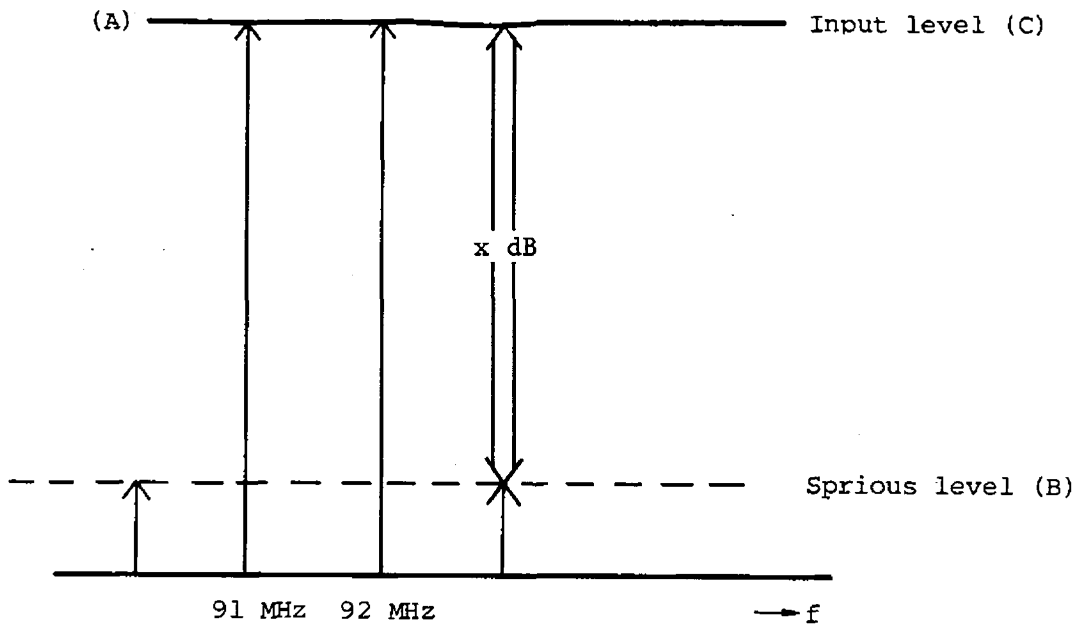


Fig. 4-4 Two-signal characteristic measurement

The intersection of the fundamental wave and the 3rd harmonic distortion is called the intercept point. It is expressed by an absolute value of the input such as XX dBm.
To determine the intercept point from the measured data, use the following formula:

$$\frac{A - B}{2} + C$$

A = Two-signal input level (dBm)
B = Spurious level (dBm)
C = Input level (dBm)

In the above example, the intercept point of the TR4172 is +20 dBm.

4-25. SIMULTANEOUS MEASUREMENT OF THE 2ND AND 3RD HARMONICS OF A RADIO TRANSMITTER

This paragraph describes simultaneous measuring procedure for the fundamental, 2nd harmonic, and 3rd harmonic outputs of a 144 MHz radio transmitter.

(1) Apply the output of the transmitter to the input of the TR4172 Spectrum Analyzer via the TR1625 RF Coupler (see Figure 4-5). The TR1625 RF Coupler has an attenuation level of 40 ±1 dB over a frequency range between 0 MHz and 1000 MHz. If the output power of the transmitter is 10 W, it is attenuated to 100 W/50 Ω (-10 dBm) when
applied to the input of the TR4172.

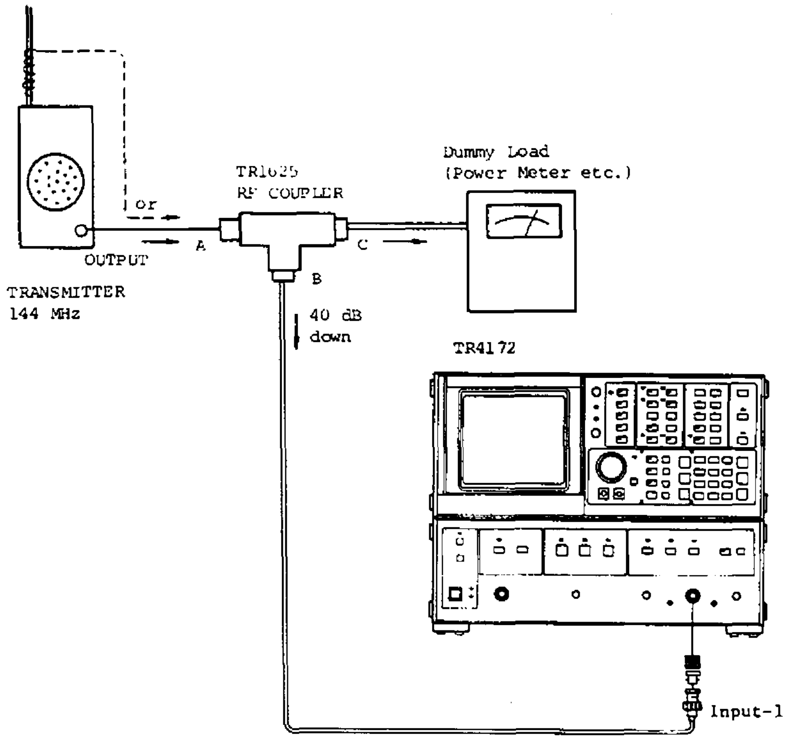
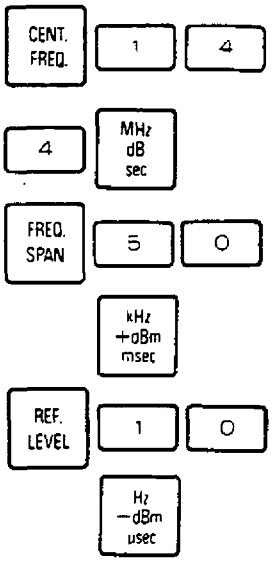
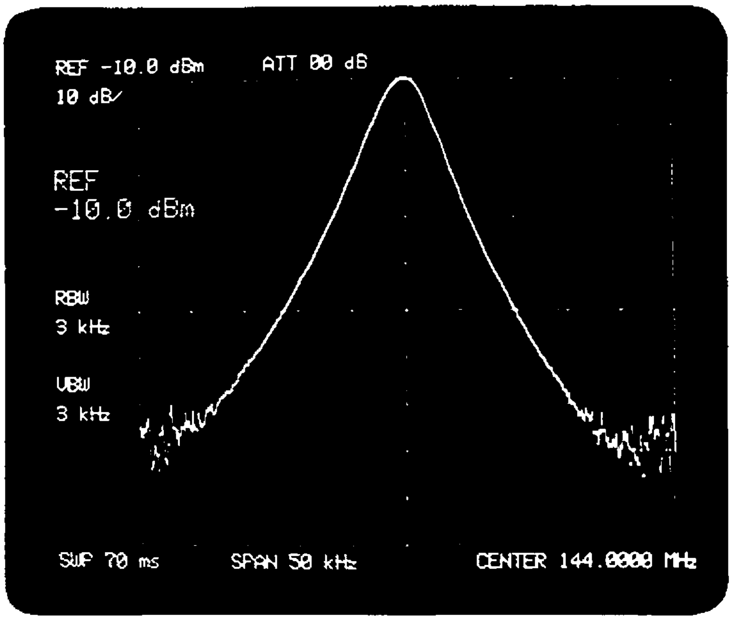


Fig. 4-5 Measurement setup

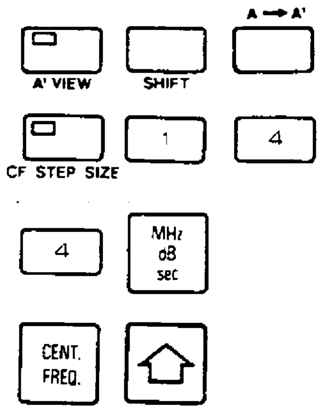
(2) When the analyzer is in its initial default state, set the center frequency to 144 MHz, frequency span to 50 kHz, and reference level to -10 dBm.

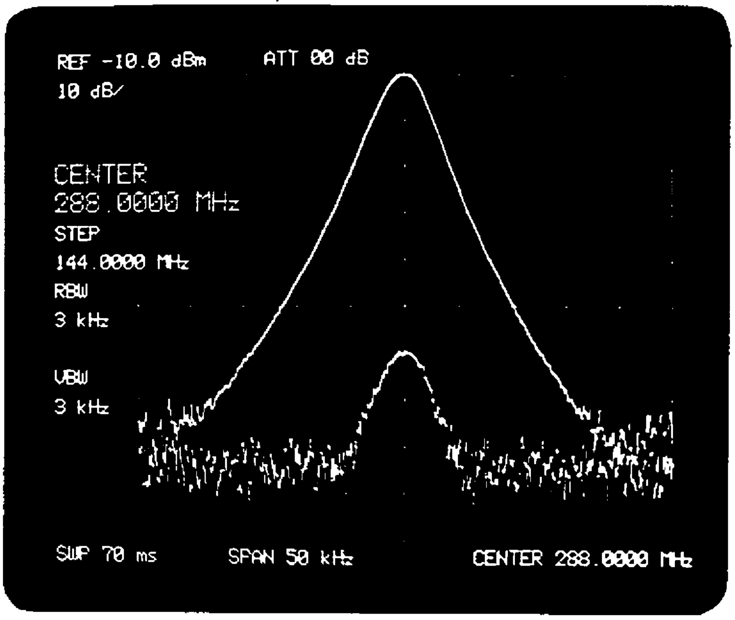




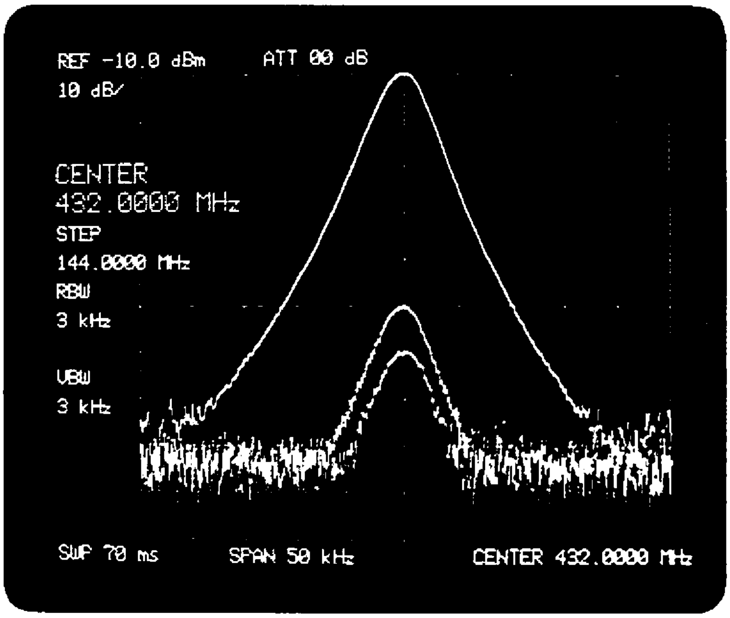
(3) Since the WRITE A mode is the initial default selection, the fundamental response trace is stored in trace memory A. Transfer this trace information into memory A' by pressing A' VIEW SHIFT A → A'.

(4) Next, double the center frequency setting to observe the 2nd harmonic in the transmitter output. If the center frequency step size is set to 144 MHz, the center frequency will be multiplied in an integral sequence (double, triple and so on) each time the STEP UP key is pressed. Use trace memories A, A', and B to superimpose higher harmonics on the fundamental response trace.





(5) Press the WRITE B key. Memory A will be automatically placed in the VIEW (still) mode. Observe the 3rd harmonic response on active display B.



⑥ The completion of these procedures will display the three screens, A', A, and B, concurrently. When four screens are needed, press the B → B' switch to store the harmonics of the third order in memory B' and the next waveform information in active screen B.

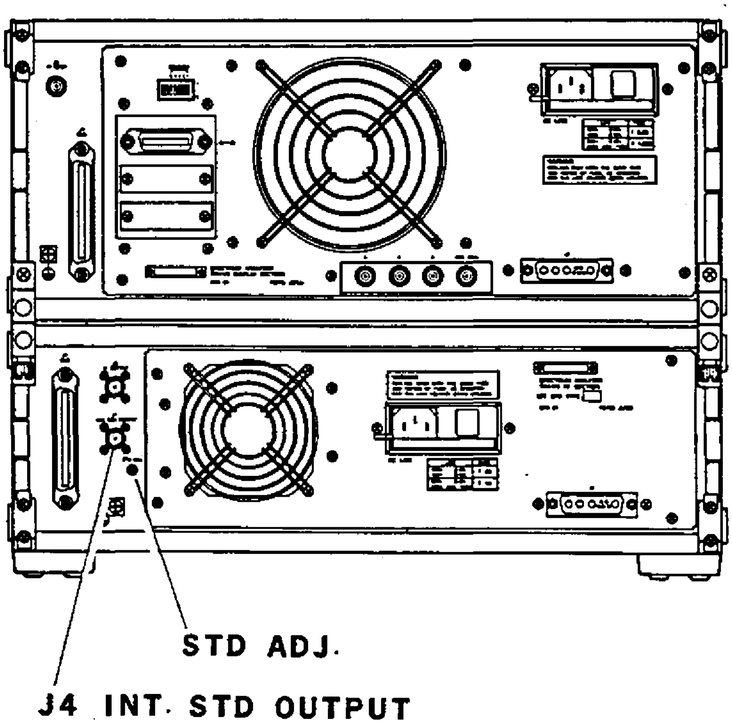
⑦ Press SHIFT A' BLANK to clear the screen of the fundamental wave stored in memory A'. Other memories can be cleared in a similar way.

4-26. INTERNAL STANDARD OUTPUT ON/OFF

When the SHIFT, LABEL, and 7 keys are pressed sequentially, the 10 MHz standard oscillator output is output from the INT. STD OUTPUT (J4) connector at the TTL level.

Measure this output with a more precise counter or frequency standard and comparator, then adjust it with the STD ADJ. control to accurately set the output to 10 MHz.

Pressing the SHIFT, LABEL, and 8 keys sequentially will cut off the internal reference oscillator output. This output is cut off when this instrument is initialized by power on operation or by pressing the MASTER RESET key.



4-27. ADJACENT CHANNEL LEAKAGE POWER ARITHMETIC OPERATION SOFTWARE (OPTION 06)

The data on trace A measured by TR4172 is divided into 1001 points on the frequency axis, the power equivalent to the width specified by the delta marker is integrated, and the ratio of the integration result to the total power is displayed on trace B.

When Pn is the power between each points on screen A, total power P is obtained from:

$$P = \sum_{n=1}^{1001} Pn$$

When ΔX is the width of a delta marker, data P_{ADJ} on screen B after arithmetic operation is obtained from:

$$P_{ADJ} = 10 \log \frac{\sum_{n-\Delta X/2}^{n+\Delta X/2} Pn}{P}$$

Two methods for integration by the ΔX width can be selected: ideal filter (ΔX width) and trapezoidal filter (ratio of 90 dB/6 dB is set in the range of 1.0-9.99).

The adjacent channel leakage power arithmetic operation procedure is as follows:

1. Measure the waveform on trace A.
2. Press the VIEW A key to freeze the trace. Specify the integration width by the delta marker.
3. Operate [ ] SHIFT, [ ] LABEL, and [1] keys.
4. Press the [2] key for integration by an ideal filter. Press the [3] key for data only. The ratio (dB) of the adjacent channel leakage power to the total power at the first marker is displayed under ADJ. The frequency at this point is displayed on the upper right of the CRT screen.
5. Press the [4] key for waveform integration by a trapezoidal filter. To obtain the dB value, press the [5] key, then select

the ratio of 90dB to 6 dB.

When the [1] key is pressed, the ratio is 2.24.

When the [2] key is pressed, the ratio is 1.75.

When the [3] key is pressed, the ratio is 1.66.

When the [4] key is pressed, any ratio may be set in the range of 1.0-9.99.

In this case, input the value of 100 X [90 dB/6 dB] by the DATA keyboard, then press the [Hz −dBm μsec] key.

The operation time is prolonged as the delta marker width increases. Sometimes, it takes more than one minute.

⑥ When the [ ]u (MKR OFF) key is pressed, or [CENT. FREQ.], [FREQ. SPAN], [REF. LEVEL] keys are operated, the ordinary measurement mode is selected.

⑦ If the [ ] (MARKER) and [□B] (VIEW) keys are pressed after pressing the [ ]u (MKR OFF) key, the marker is moved to the integration waveform on trace B. Thus, the ratio (dB) to the total power at any marker point can be read. In this case, press the [ ] (SHIFT) and (REF. OFFSET) [REF. LEVEL] keys, input the offset value, and then set the reference level to 0 dB, because the integration waveform is drawn with reference to the total power. Accordingly, if the reference level is set to 0 dB including the offset, the value at the marker can be read out directly. When an integration waveform is drawn, the waveform on both ends of the display become zero waveforms (approximately 1/2 of the integration width).

⑧ Occupied bandwidth can be measured by operating [ ] (SHIFT), [ ] (LABEL), [1] keys and then pressing the [1] key again.

It also can be measured by pressing the [ ] (MARKER) key after the measurement of adjacnet leakage power arithmetic operation.

⑨ If the [Δ] key is pressed before selecting the ordinary measurement mode by pressing the [MKR OFF] key, the integration trace can be plotted directly by TR9831 or TR9834R plotter.

Note) "ADJ" displayed on the CRT means adjacent.

4-28. X-Y PLOTTER INTERFACE (OPTION 07)

This option is a software program allowing connection to the Hewlett Packard Model 9872A/7470A/7225A Plotter. This option must not be used together with option 03; however, combined use with other options is permitted. Read the instruction manual for the purchased plotter before connecting a plotter to the TR4172, switching the plotter power on, or setting the pen. Set the 9872A address to "5", and other plotters' addresses to "listen only".

Note: Set the TRACE MODE to VIEW, before plotting the averaged waveforms in HP output format.

The X-Y plotter interface operating procedure is as follows:

① Display the waveform (Smith chart) to be plotted on the TR4172 CRT screen.

② Operate the [SHIFT], [LABEL], and [2] keys to load the program.

③ The following is displayed on the CRT:

9872A	: '1'	7470A	: '2'
7225A	: '3'	QUIT	: '4'

Press one of the [1], [2], or [3] key according to the type of the connected plotter.

If the [4] key is pressed, the state before program loading is restored.

If the message above is not displayed instantly,

"<ERROR> PLOTTER DOWN OR ADDRESS SW. IS NOT "5" OR CONNECTER DRAWN OUT RERUN OR QUIT <1 OR 0>"

is displayed approximately 5 seconds later. If this message is displayed, check if the plotter is powered on, plotter's address switch is set to "5" or "listen only", and connector is properly connected.

To execute the plotter program again, press the [1] key.

If the [0] key is pressed, the state before program loading is restored.

(4) Then, the following is displayed on the CRT:

ALL : '1' DATA : '2'

QUIT : '3'

To plot all data on the CRT screen, press the [1] key. To display only the waveform, press the [2] key.

If the [3] key is pressed, the state before program loading is restored.

In the Smith chart list mode, plotting starts without displaying the above message.

(5) Then, the characters, which were displayed in the center of the left half of the CRT screen (active area) before program loading, are displayed again and plotting starts.

Table 4-6 Pen numbers

Trace / Model	TRACE "A"		TRACE "B"	
	A	A'	B	B'
9872A	2	4	3	1
7470A	1	1	2	2

(6) If the [SHIFT] key is pressed while the plotter is runnning, plotting is forcibly stopped and plotter selection menu is displayed on the CRT. Change the plotting paper and follow the operation procedures from item (3) again.

CAUTION

To plot an averaging waveform, it is necessary to set TRACE function to the VIEW mode before commencing an actual plotting. (See Section 4-10.)

4-29. N dB DOWN WIDTH MEASUREMENT

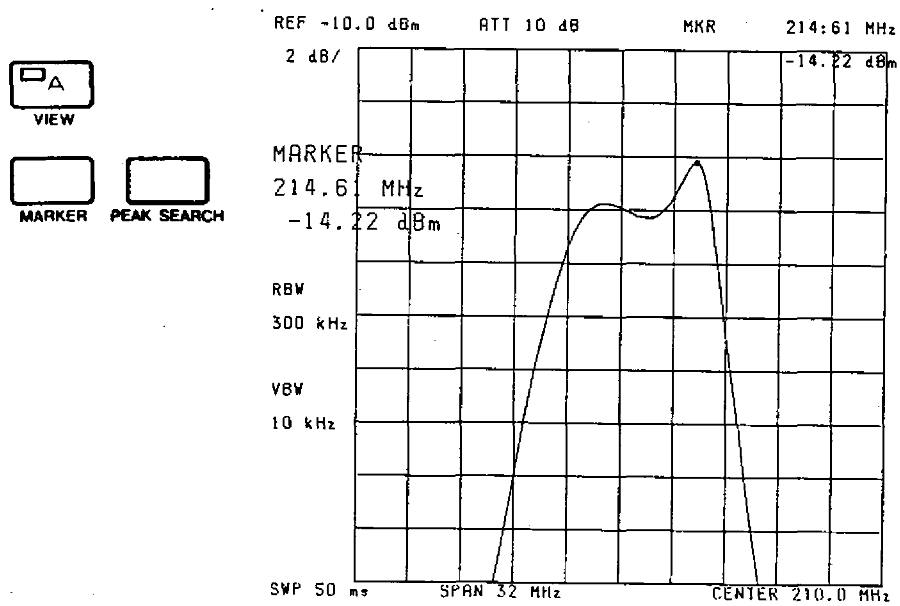
4-29-1. Specification

Displays two markers at the level N dB below the preset marker on the waveform; and displays a frequency differences between the two markers or their frequency differences with respect to the center frequency, and the frequency and amplitude level of the left marker.

4-29-2. Operating Procedures

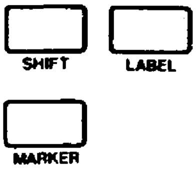
Note: This mode can be used when the vertical scale is in the logarithmic scale of 10 dB/div to 1 dB/div.

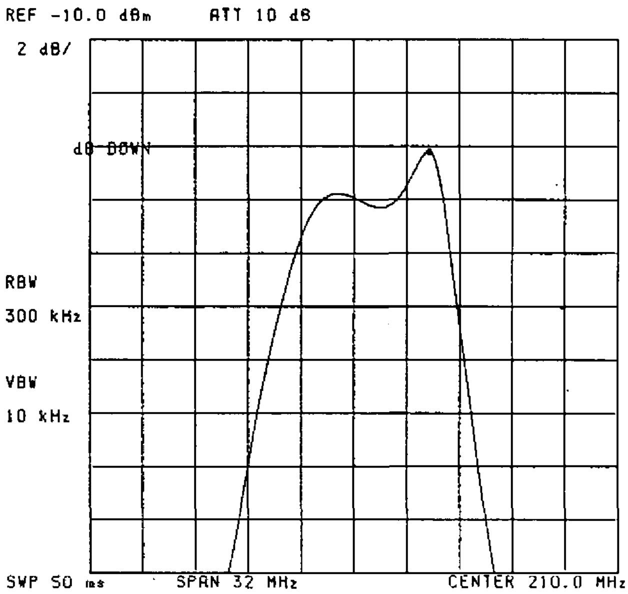
(1) Set the waveform in the VIEW mode to freeze it. Display a regular marker and move it to the desired peak.



② Press the [SHIFT], [LABEL], and [MARKER] A keys in this order. This option program is loaded and this mode becomes active. "dB DOWN" is displayed in the active function area at the middle left of the CRT.

If this key operation is performed when the regular marker is not displayed or when the delta marker is displayed, the analyzer enters the NEXT PEAK mode.





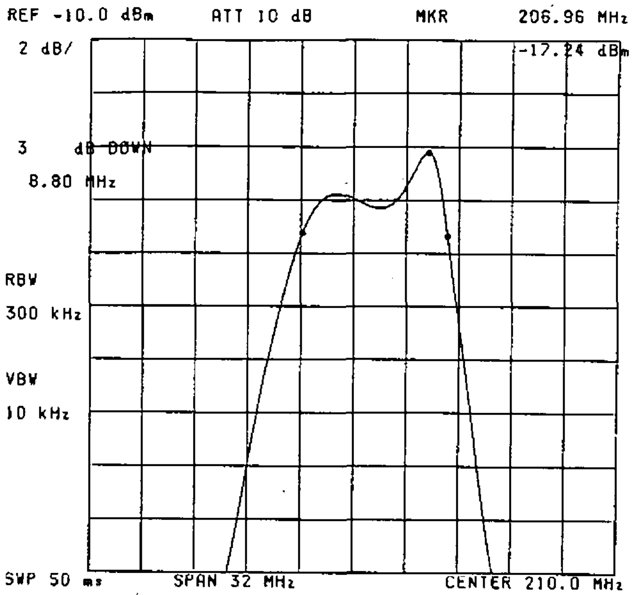
③ Enter a down level from the peak using the DATA keyboard. Acceptable data is from 0.1 dB to 99.9 dB.

(Example)

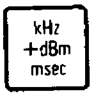
[1] [0] [•] [5] ..... 10.5 dB

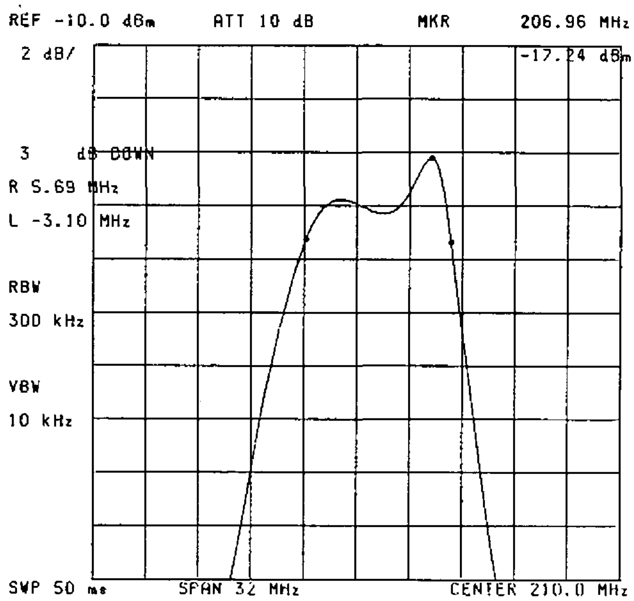
④ Press the [MHz dB sec] or [kHz +dBm msec] key. A marker is displayed at the right and left side points on the waveform N dB (input value) below the preset marker.

A frequency differences between the right and left markers is displayed in the active function area at the middle left of the CRT when the [MHz dB sec] key is pressed,



and a frequency differences of the left marker (headed by "L") and right marker (headed by "R") with respect to the center frequency when the [kHz +dBm msec] key is pressed.





In both cases, the frequency and amplitude level of the left marker are displayed in the marker area at the upper right corner of the CRT.

"ERROR" is displayed in the active function area when an entered value is beyond the required size (0.1 dB to 99.9 dB) or when the waveform does not exist at the level N dB below the preset marker. In such a case, repeat the operation from step 3 again.

5 Operation from step 3 can be repeated.

6 The following three ways are available to exit from this mode:

- Press the MKR OFF key. Execution exits from this mode with the marker off.
- Press the MARKER key. Execution exits from this mode with the central marker changed to the normal marker.
- Press the Δ key. Execution exits from this mode with the right and left markers changed to the delta markers.

When a function key other than the above is pressed, execution exits from this mode. In this case, however, the marker is not cleared. So, press the MKR OFF key to clear the marker after setting this mode again.

To set N dB DOWN WIDTH mode after exiting from this mode, start from the beginning.

4-29-3. Operation by GPIB

The remote operation by GPIB is performed accordingly, by programming codes corresponding to the panel keys operated in the manual operation in the same order.

4-30. NEXT PEAK SEARCH FUNCTION

4-30-1. Specification

Displays positive peaks in descending size order, negative peaks in ascending size order, or positive and negative peaks in left-to-right order in the section specified on the waveform by the delta marker.

4-30-2. Operating Procedures

1. Set the waveform in the VIEW mode.
2. Specify the section to be measured by the delta markers.
3. Press the [SHIFT], [LABEL], and [MARKER] P keys in this order. This option program is loaded and this mode becomes active.

   The following messages are displayed in the active function area at the middle left of the CRT:

   POS. NEXT: 'R'

   NEG. NEXT: 'S'

   LEFT NEXT: 'T'.

   If this step is performed with no marker displayed, a marker is displayed at the right and left ends of the trace. Then, these two markers become the delta markers.

   If this step is performed with the regular marker displayed, the analyzer enters the N dB DOWN WIDTH mode.
4. When the [ ] R key is pressed, a marker is displayed in the position of the maximum positive peak in the section specified by the delta markers, and its frequency and amplitude level are displayed.

   Then, every time the [PEAK SEARCH] V key is pressed, a positive peak in the section specified by the delta markers is displayed in descending size order. The place of a displayed peak in a series is displayed in the active function area.

   When the [ ] S key is pressed, a marker is displayed in the position of the minimum negative peak in the section specified by the delta markers, and its frequency and amplitude level are displayed.

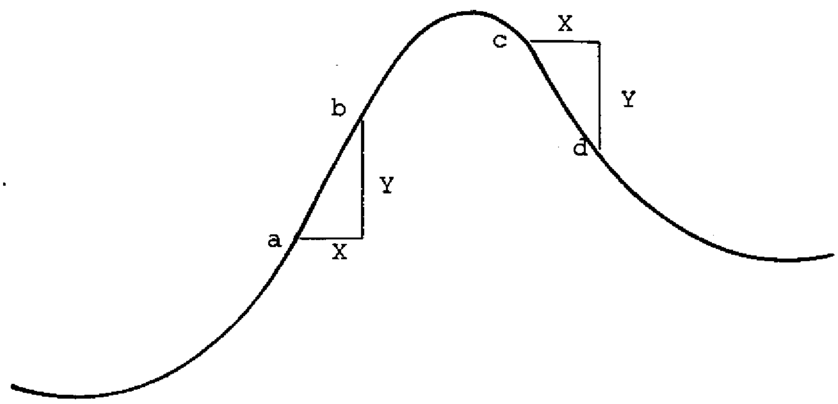
Then, every time the [PEAK SEARCH] V key is pressed, a negative peak is displayed in the section specified by the delta markers in ascending size order. The place of a displayed peak in a series is displayed in the active function area.

When the [▭] T key is pressed, a marker is displayed in the position of the leftmost peak in the section specified by the delta markers, and its frequency and amplitude level are displayed.

Then, every time the [PEAK SEARCH] V key is pressed, peaks in the section specified by the delta markers, both negative and positive, are displayed in left-to-right order. The place of a displayed peak in a series of positive or negative peaks--"+N" or "-N"--is displayed in the active function area.

5. To exit from this mode, follow the procedure outlined in step 6 of Section 4-29 "N dB DOWN WIDTH MEASUREMENT".

6. To obtain, for example, the maximum positive value by using this program, point a where the slope of the waveform exceeds $\Delta Y/\Delta X$ is obtained. Next, point d of a slope of $-\Delta Y/\Delta X$ is obtained. Then, the maximum value between these two points is obtained.



The initial values of ΔX and ΔY are 20 and 5 points respectively for a CRT resolution of 1001 x 1001 points. By changing ΔX and ΔY, the sensitivity of peak detection can be changed.

For instance, the entry " $\boxed{}$X $\boxed{3}$ $\boxed{0}$ $\boxed{\text{Hz} \; -\text{dBm} \; \mu\text{sec}}$ " from the DATA keyboard sets ΔX to 30 points. The entry " $\boxed{}$Y $\boxed{2}$ $\boxed{0}$ $\boxed{\text{Hz} \; -\text{dBm} \; \mu\text{sec}}$ " sets ΔY to 20 points.

The number of points, both ΔX and ΔY, can be set within the 1 to 255 range.

4-30-3. Operation by GPIB

The remote operation by GPIB is performed accordingly, by programming codes corresponding to the panel keys operated in the manual operation in the same order.

4-31. START/STOP FREQUENCY SETTING

In addition to setting the center frequency and frequency span, this device sets start and frequencies by pressing [SHIFT], [6], [1]. In this mode, the [CENT. FREQ.] switch is used to set the start frequency and the [FREQ. SPAN] switch is used to set the stop frequency. The setting resolution of the frequency difference between the start and stop frequencies is the same as the one set in the normal center frequency and frequency span setting modes.

Start and stop frequency can be set in the 0 - 2000 MHz frequency range.

Pressing [SHIFT], [6], [1] key, here will result in normal center frequency and frequency span mode.

Note that the SIGNAL TRACK and ZOOM switches cannot be used in this mode.

4-32. Gated Sweep Function (Option 12)

> **Note**
>
> When this option is mounted, the X-Y recorder output (option 03) cannot be incorporated.

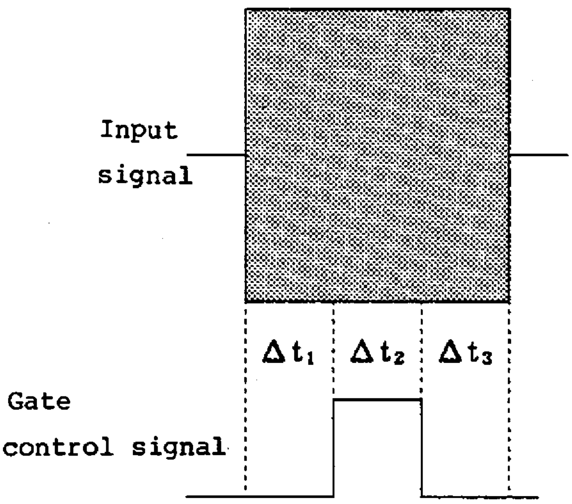
4-32-1. General

This option allows analysis of the burst signal, which is often used when magnetic tape such as VTR, 8mm video, or DAT (digital audio tape) is recorded.

4-32-2. Measurement method

Executes sweep from the gate in the terminal (BNC connector) on the rear panel of this unit at TTL level "Hi" (or open) and stops sweep at "Lo".

Input signal and gate control signal are used in the following specifications.



< Standard >

Δt_2: 15μs or above

Δt_3: 1μs or above

RBW	1MHz	300kHz	100kHz	30kHz	10kHz
Δt_1	10μs or above	15μs or above	20μs or above	50μs or above	180μs or above

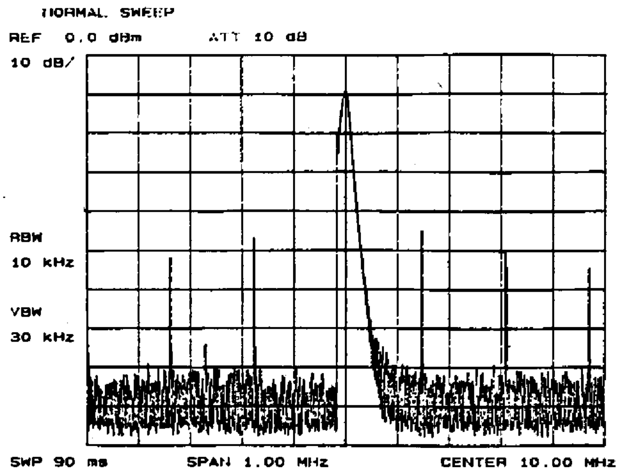
(Note) At video BW 300kHz or above

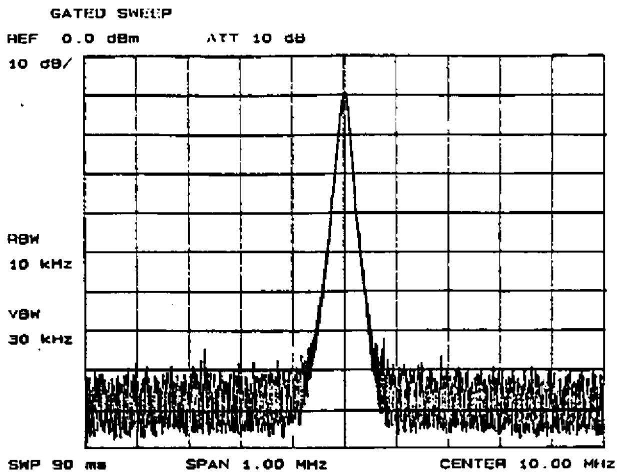
When measuring noise, select the detection mode to SAMPLE (SHIFT AUTO z).

4-32-3. Measurement examples

The data comparison diagram between normal sweep and gated sweep is as follows:

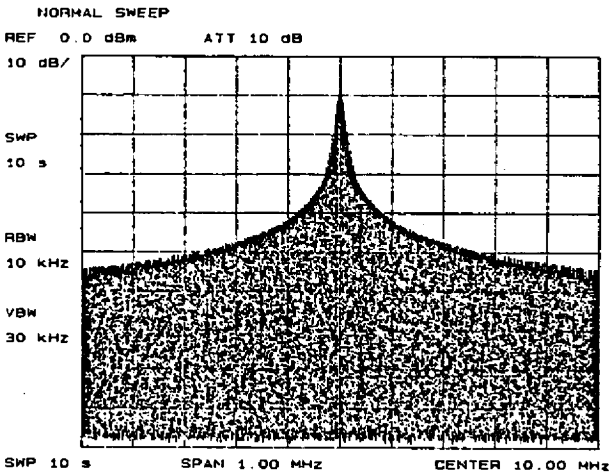
[Normal Sweep] [Gated Sweep]

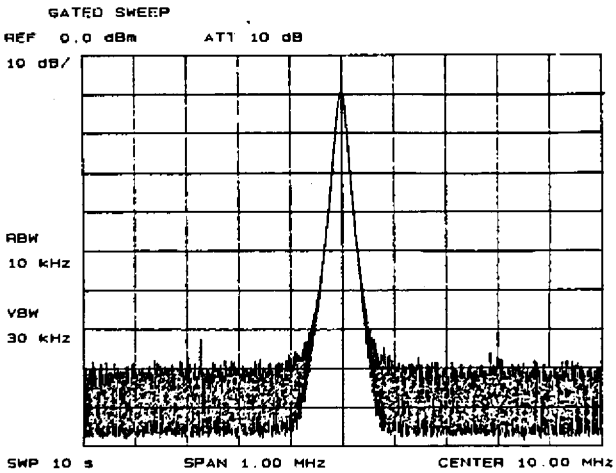




(1) On normal sweep, the pulse component in the burst part is on the data or part of data is lacking.

(2) On gated sweep, the spectrum of the signal in the burst can be analyzed the same as usual.





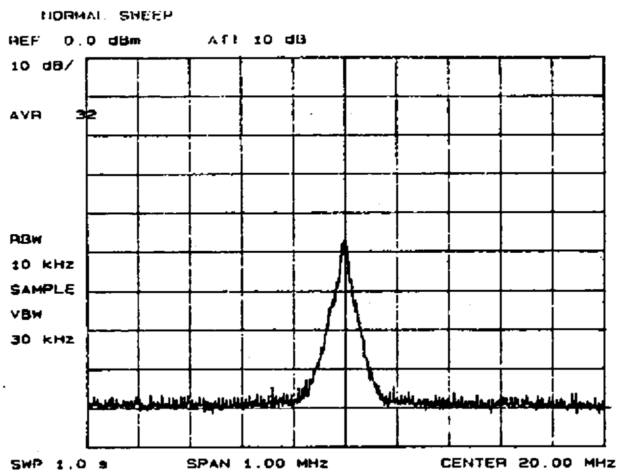
(3) On normal sweep, when sweep time slows down, the pulse component in the burst part appears as an envelope.

(4) On gated sweep, the spectrum of the burst signal part can be analyzed even if the sweep time slows and resolution increases.

Fig. 4-6 Data comparison between normal sweep and gated sweep

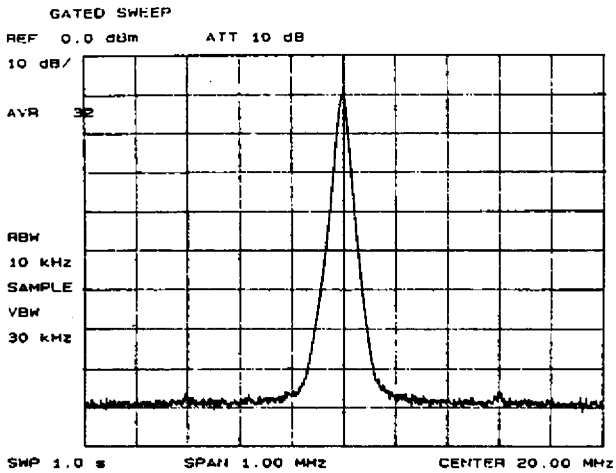
(continues to the next page)

[Normal Sweep]



(5) If the averaging is executed when the bust signal is measured, the conventional measurement cannot be made as shown in the above diagram.

[Gated Sweep]

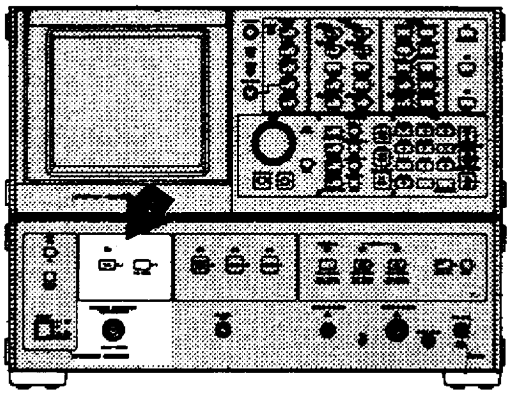


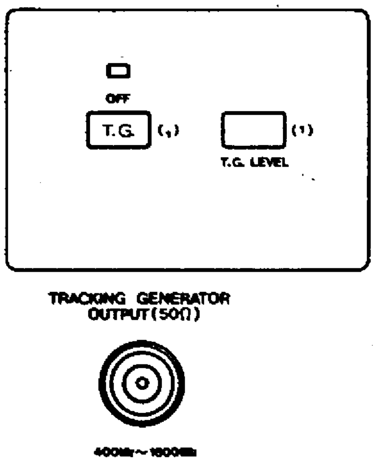
(6) On gated sweep, the C/N of burst signal can be measured even if the averaging is executed.

Fig. 4-6 Data comparison between normal sweep and gated sweep (cont'd)

SECTION 5

TRACKING GENERATOR OPERATIONS





5-1. OPERATING TRACKING GENERATOR

1. Press the POWER switch to the ON (in) position.
2. Set up the analyzer for the following conditions:

Center frequency	900 MHz
Frequency span	1800 MHz
Reference level	-10 dBm
Resolution bandwidth	300 kHz
INPUT attenuator	10 dB

3. Press the T.G. key to activate the tracking generator; the indicator lamp just above the key lights.
4. The T.G. LEVEL key, when pressed, enables output attenuation level for the tracking generator to be controlled in 10 dB steps using the DATA step keys.
   Press the T.G. LEVEL key and set the tracking generator's output attenuator to 10 dB using the DATA step keys.
5. Connect the TRACKING GENERATOR OUTPUT connector to the INPUT connector with a coaxial cable. The CRT display will present a through frequency response.
6. Disconnect the coaxial cable from the INPUT connector and then reconnect it to the input of the device under test.
   Press the T.G. LEVEL key and set the tracking generator's output attenuator to an appropriate level between 0 dB and 50 dB. The output impedance of the tracking generator is approximately 50 Ω.

(7) Connect the output of the device under test to the INPUT connector of the analyzer using another coaxial cable. The input impedance of the analyzer is approximately 50 Ω.

(8) The noise level can be lowered and hence a broader dynamic range can be obtained by narrowing the IF bandwidth using the RES. BW key. Note, however, that a resolution bandwidth reduced below 100 Hz can cause a tracking error (deviation of tracking generator's output frequency from analyzer's tuning frequency), which eventually results in a level error. In this case, adjust the displayed signal level to the maximum with the T.G. FREQ. ADJ. control. Set the frequency span to 10 kHz, sweep time to relatively long, and step down resolution bandwidth from 300 Hz to 100 Hz, 30 Hz, and 10 Hz while adjusting the T.G. FREQ. ADJ. control until the maximum signal level is obtained.

(9) To disable the tracking generator, press [SHIFT] [T.G. (OFF)]; the indicator lamp above the T.G. key will go off.

5-2. FREQUENCY RESPONSE COMPENSATION USING A DISPLAY LINE

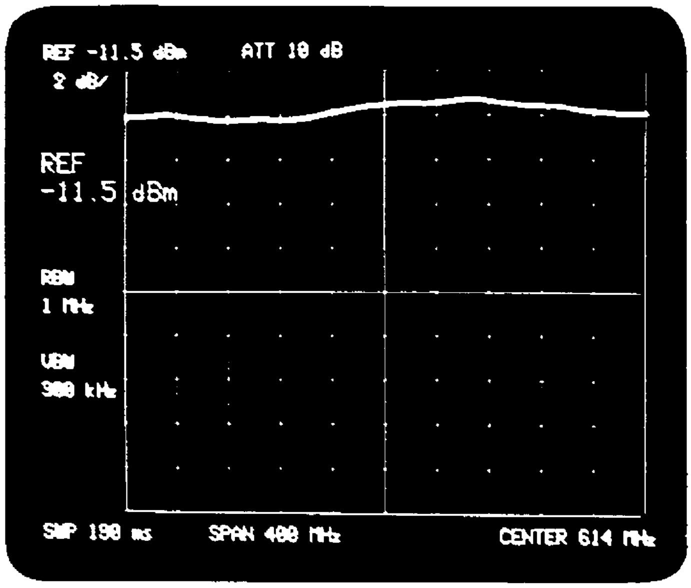
This paragraph describes frequency response compensation for the spectrum analyzer itself or an interconnecting cable (for filter response measurement, etc.) by using the TRACE function and a display line.

5-2-1. Compensation Using the SHIFT and MHz Keys

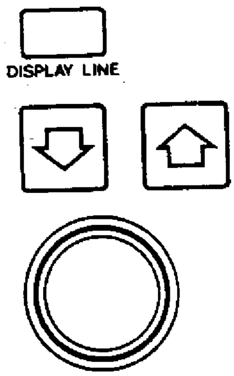
(1) Press the WRITE A key to place the analyzer in the WRITE A mode.

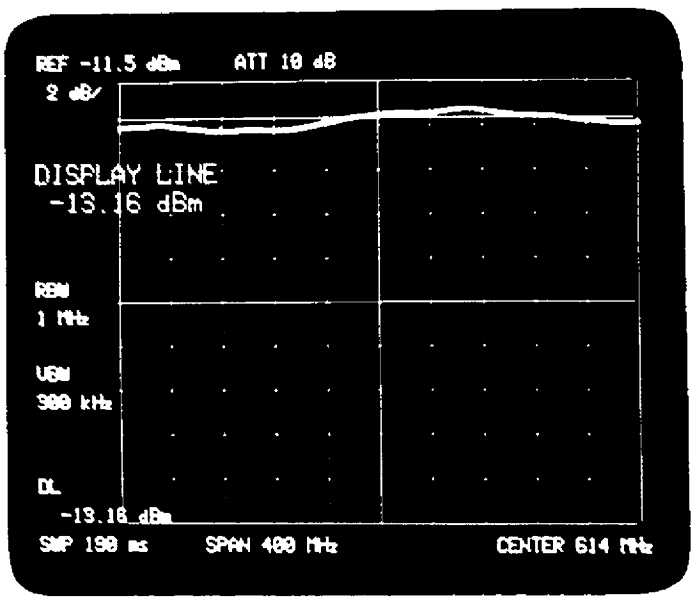
(2) Disconnect the device under test from the measuring setup and connect the TRACKING GENERATOR OUTPUT connector to the INPUT connector of the analyzer directly with a coaxial cable.

(3) Press the REF. LEVEL key and adjust the reference level with the DATA knob and/or DATA step keys until the through frequency response is lowered to the level shown in the following figure:

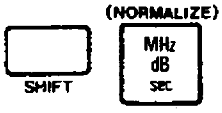


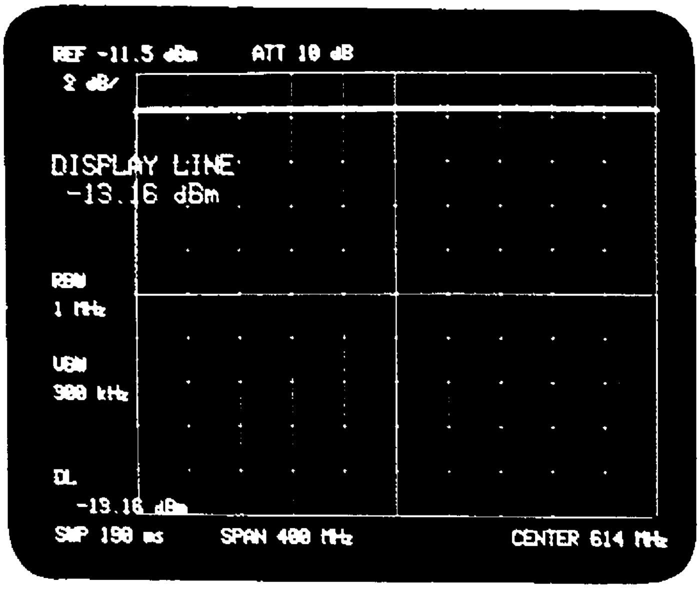
④ Press the DISPLAY LINE key to activate a display line.
Using the DATA step keys and DATA knob, position the display line close to the through signal response.
A broader dynamic range can be obtained as the display line is positioned closer to the through signal response.





⑤ Analyzer's frequency response compensation is accomplished by pressing the SHIFT and MHz keys as below:

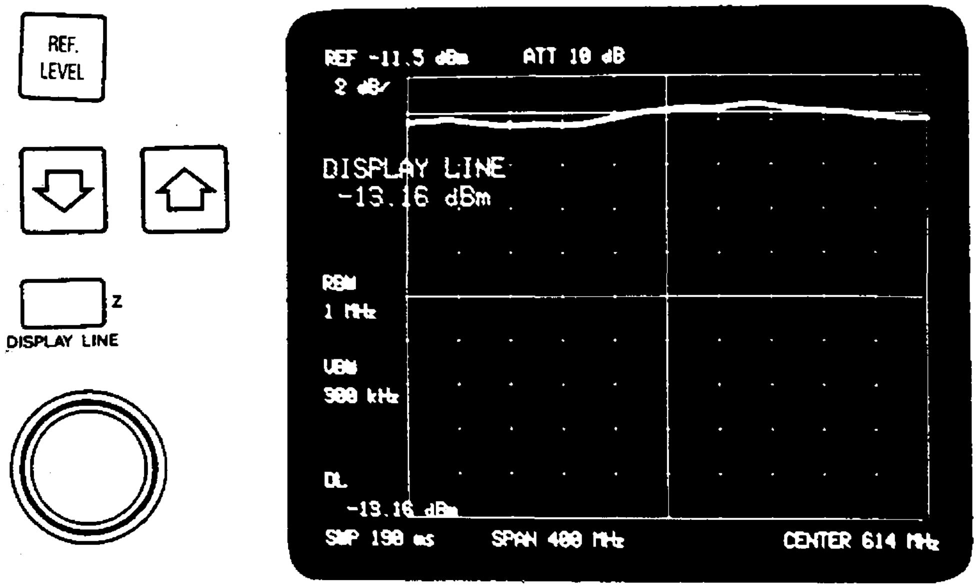




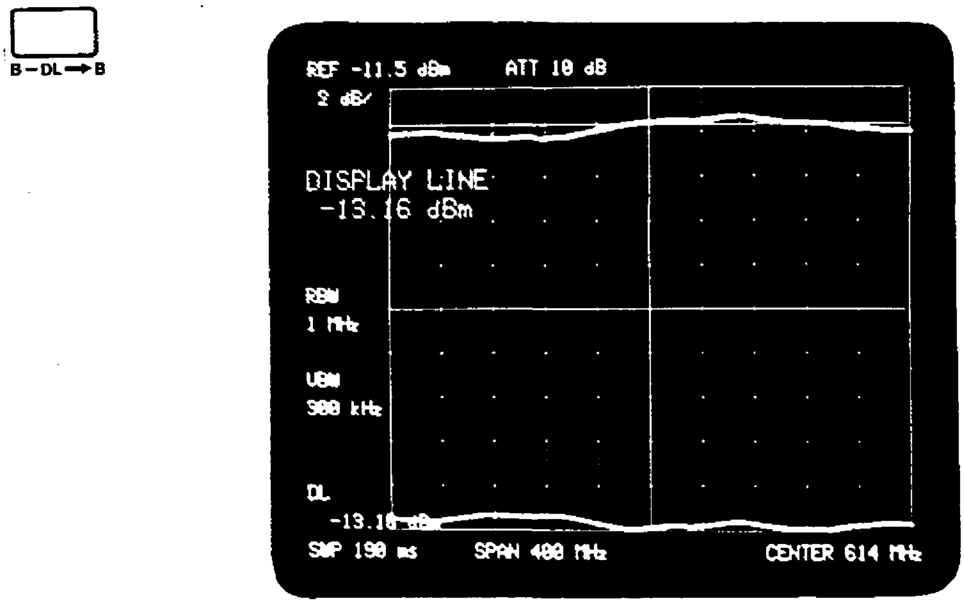
6. The compensation procedure described in steps 1 through 5 above is an automatic version of the procedure using the B-DL→B and A-B→A keys which will be described in the following paragraph. Therefore, the analyzer is placed in the A-B→A mode after the frequency response compensation is completed and the indicator lamp on the A-B→A key lights.
   To disable frequency response compensation press the SHIFT and A-B→A keys to clear the A-B→A mode. Do not press B WRITE switch when this mode is used.

5-2-2. Compensation Using the B-DL→B Key

1. Press the WRITE B key to place the analyzer in the WRITE B mode.
2. Disconnect the device under test from the measuring setup and connect the TRACKING GENERATOR OUTPUT connector to the INPUT connector of the analyzer directly with a coaxial cable.
3. As described in Section 5-2-1, activate a reference level and display line, and position the display line close to the through signal response.

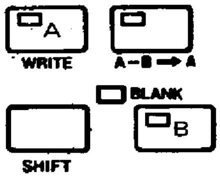


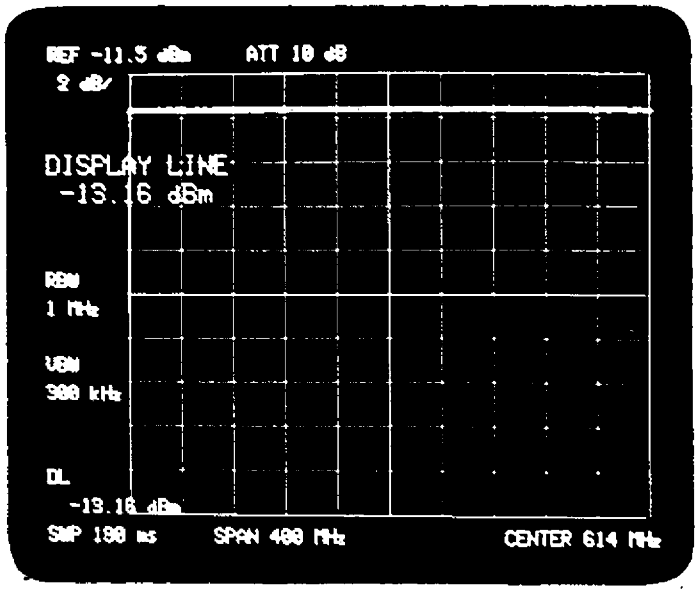
④ Press the B-DL→B key. The difference between the through signal response and the display line is written into memory B and then transferred to the CRT display.
Memory B is placed in the VIEW B mode.



⑤ Press the WRITE A key and then A-B→A key.
Connect the device under test to the measuring setup.
The frequency response is now compensated and displayed on the CRT.

⑥ It is advisable that the SHIFT and B BLANK keys be pressed to erase trace B from the display.





⑦ Compensation for this frequency response is executed while the LED in the [A-B→A] switch illuminates. This mode is called as a normalize mode. In the normalize mode, the [B WRITE] key is not usable, since normalizing operations are performed on data for each sweep using memory B.

⑧ If the both display mode is desired while normalization is being performed, use memories A and A'. Note, however, that the previous contents of memory A' may be modified if normalization using [SHIFT] and [(NORMALIZE) MHz dB sec] is performed (see 5-2-1).
The contents of memory A' will not be affected if normalization is executed with the [A-B→A] key (See 5-2-2).

⑨ In the normalize mode, the alternate sweep feature is not available, since memory B is not usable. (See 4-14-6 ⑥, 6-2, and 7-3)

⑩ Operation of [SHIFT] [OFF A-B→A] clears the normalize mode, with the LED in the [A-B→A] key turned off.

⑪ Before executing normalization, select BLANK A' & BLANK B' mode, or VIEW A' & VIEW B' mode.

5-3. IF QUARTZ FILTER MEASUREMENT USING TRACKING GENERATOR

This paragraph provides on example of how to measure the insertion loss, ripple, 3 dB bandwidth, and attenuation of a communication purpose IF quartz filter using the tracking generator of TR4172.

5-3-1. Connecting the TR4172 and the Xtal filter

(1) As shown in Figure 5-1, insert a DUT (filter) between the TR4172 TRACKING GENERATOR OUTPUT connector and the INPUT connector. This state of connection is called (a). The state of the two connectors being kept through with the DUT removed is called (b).

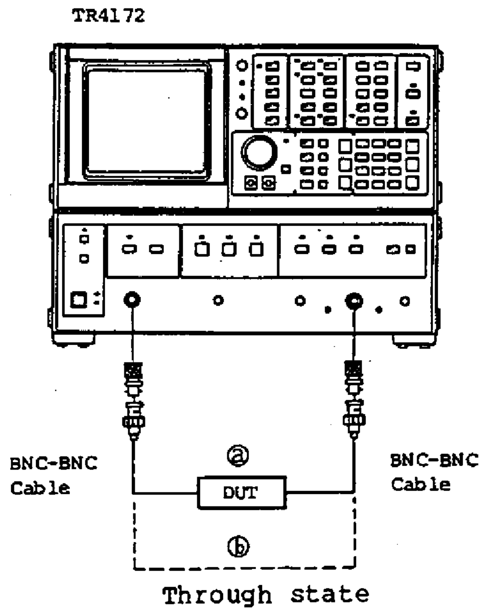


Fig. 5-1 Connecting the TR4172 and the Xtal filter

(2) Connection notes

① If the input and output impedances of the DUT differ from those of the TR4172 (50 ohms), match the impedances at the input and output.

② If the filter insertion loss is large, a satisfactorily wide dynamic range may not be achieved, in which case use a preamplifier (option 02) at the input.

5-3-2. Measuring procedure

The following procedure assumes that the DUT is a bandpass filter having the following characteristics:

- Center frequency : 70 MHz
- Pass bandwidth : 25 kHz
- Insertion loss : Less than 5 dB
- Ripple : Less than ±1 dB
- Attenuation : More than 70 dB

(1) Set up the analyzer for 70 MHz center frequency, 100 kHz frequency span, 0 dBm reference level, and 10 dB input attenuator. (Note)

(2) Activate the tracking generator output and check the T.G. output level with the DUT disconnected as shown in Figure 5-1. (b). The T.G. output level should be 0 dBm when the input attenuator is set 0 dB.
Since the frequency span is 100 kHz, the display will show a horizontal straight line. However, perform normalyze as follows:

(2)-1 Press [DISPLAY LINE], then use [⇧] or DATA knob to position the display line to an appropriate level near the top graticule.

(2)-2 Now press [SHIFT] [MHz dB sec (NORMALIZE)] in the WRITE A mode to adjust the response.
If the normalizing should be cleared, press [SHIFT] [A-B→A (OFF)].

(3) Connect the DUT as shown in Figure 5-1 (a). The insertion loss of the DUT is now read as the level difference between the marker point and display line.

Note: In the above example, the insertion loss is defined at the center frequency. In some cases, it may be defined at the peak or average of ripple.

(4) Now the pass bandwidth of the DUT (3 dB down points both sides of the center frequency) is determined as follows:

(4)-1 Press [MARKER] [Δ], then use the Data knob to search for the 3 dB down point.

(4)-2 When the 3 dB point is found, press [Δ] again.

(4)-3 Use the DATA knob to read the frequency at which the level is 0 dB. This frequency denotes the 3 dB pass bandwidth.

(5) Ripple measurement

(5)-1 Press [PEAK SEARCH] [MKR→REF.] to position the maximum peak of the signal response to the reference level.

(5)-2 Press [SHIFT] [4 (1dB/DIV.)] to change the vertical scale from 10 to 1 dB/div.

Note: Clear the adjustment mode if it has been selected.

(5)-3 Press [PEAK SEARCH], [Δ], then use the DATA knob to read the difference between the maximum and minimum peak level. This difference denotes the ripple level.

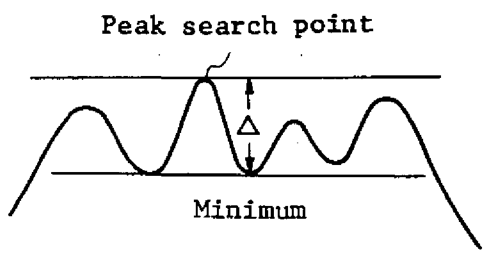


Fig. 5-2 Ripple level

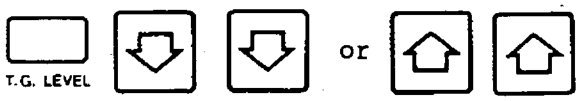
(6) Attenuation measurement

(6)-1 If the vertical scale was expanded through the above measurement, to 1 dB/div. for example, return it to 10 dB/div. Press [SHIFT] [7 (10dB/DIV.)] (returns to 10 dB/div.)

(6)-2 If the insertion loss of the DUT is too great, the measuring dynamic range is reduced accordingly. To maintain the dynamic range, use a preamplifier at the input of the analyzer. (See Figure 5-2.) Whether the preamplifier is to be inserted in the input or output of the DUT will depend on the condition of the DUT itself.

The characteristics of the preamplifier (amplification factor, frequency response, noise figure, maximum input, VSWR, and input impedance) should be checked beforehand.

The preamplifier (option 02) is equivalent to ⓑ in Figure 5-3. If the T.G. output level is too high, it can be attenuated by up to 50 dB at 10 dB steps as follows:



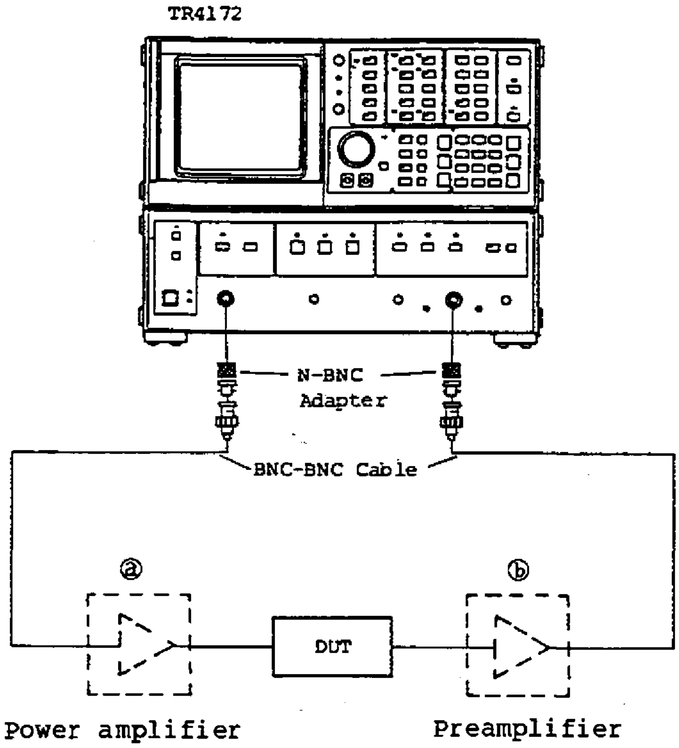


Fig. 5-3 Connecting filter and TR4172 via preamplifier

⑥-3 Connect the DUT to the instrument.

The following measurement information will be obtained for a band-pass filter (select an appropriate frequency span for this measurement):

Press [PEAK SEARCH], [Δ], [⇩], [⇩] or [⇧], [⇧].

Using the delta marker, measure the attenuation (X dB).

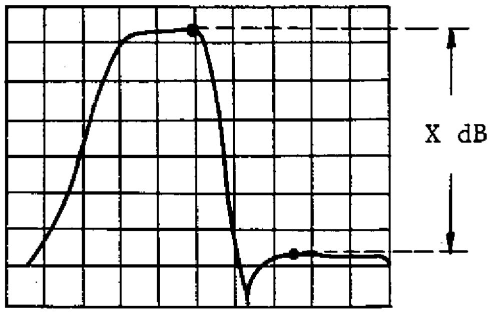


Fig. 5-4 BPF attenuation measurement

MEMO

SECTION 6

PHASE MEASUREMENT

6-1. PHASE MEASUREMENT PROCEDURE

This paragraph describes phase measurement procedure for amplifiers or filters. Before proceeding with phase measurement read SECTION 5 carefully.

1. Set center frequency, frequency span, resolution bandwidth, sweep time, and other necessary conditions.
2. Connect the TRACKING GENERATOR OUTPUT to the input of the device under test (amplifier or filter), and connect the output of the device under test to the INPUT of the analyzer. Activate the tracking generator.
3. Press the NORMAL key to measure the pass-band response of the device under test. According to the measurement result, select the appropriate T.G. LEVEL and INPUT ATT. level.
4. Then press the PHASE key to select the phase measurement mode. The display will present measurement range XX^{o}/ at its top left corner, and the indicator lamp just above the PHASE key will illuminate. In the Phase Measurement mode press the SWEEP TIME key to manually select the appropriate sweep time (the AUTO mode is programmed for amplitude measurement).
5. For more precise phase measurement without the affect of phase error of the measuring system, disconnect the device under test from the measuring setup, then connect the input and output cables by using an inline plug adapter to check the phase response of the measuring system itself.
6. If phase rotation is observed as shown in Figure 6-1, press the kHz G.D. OFFSET key to activate the electrical length.

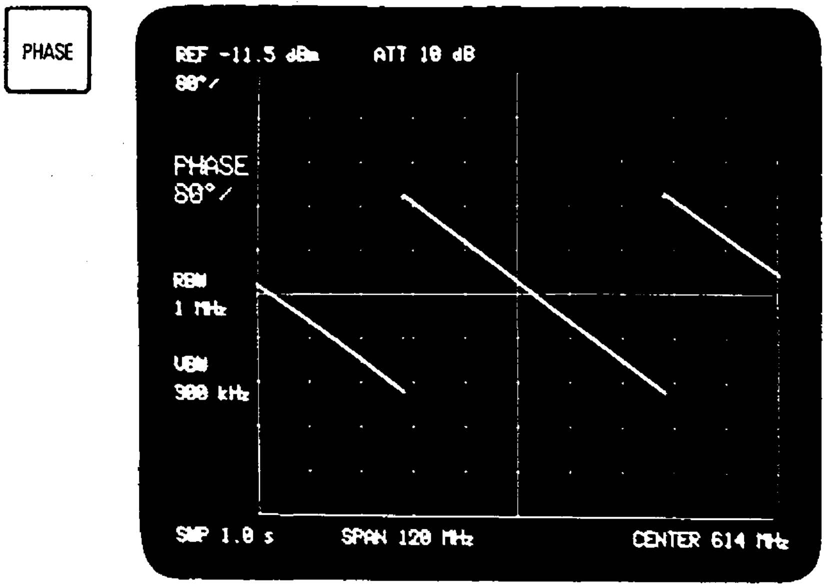


Fig. 6-1 Phase in rotation

Using the DATA knob or DATA step keys (DATA keyboard is not available for this adjustment), adjust the electrical length until a flat phase response is obtained. (See Figure 6-2.) When phase or group delay is activated, the MHz and kHz keys have the PHASE OFFSET and GROUP DELAY OFFSET functions respectively as named below the respective keys. Operation of the SHIFT key is not needed.

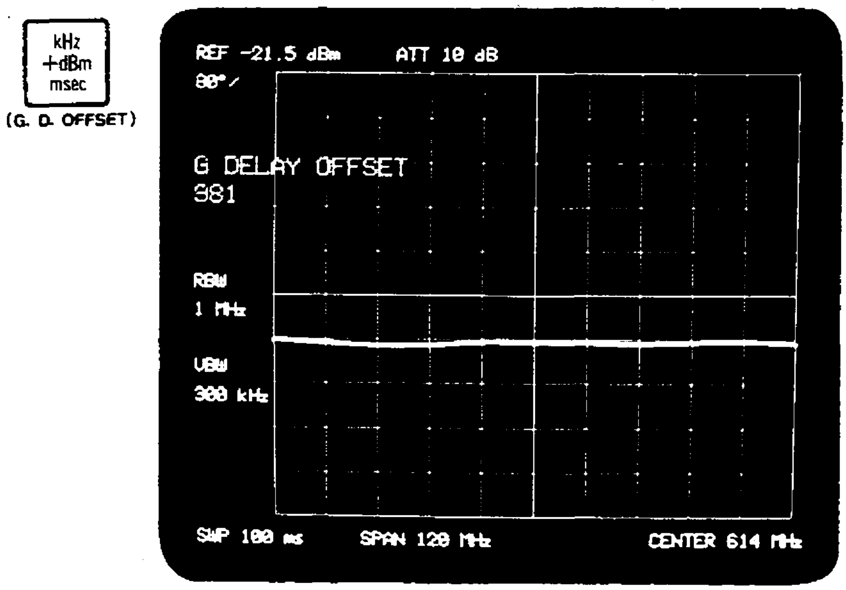


Fig. 6-2 Flat phase response

⑦ For fine adjustment of the electrical length, press the G.D. OFFSET key again. This will activate the G DELAY OFFSET FINE mode to permit fine adjustment of the electrical length.

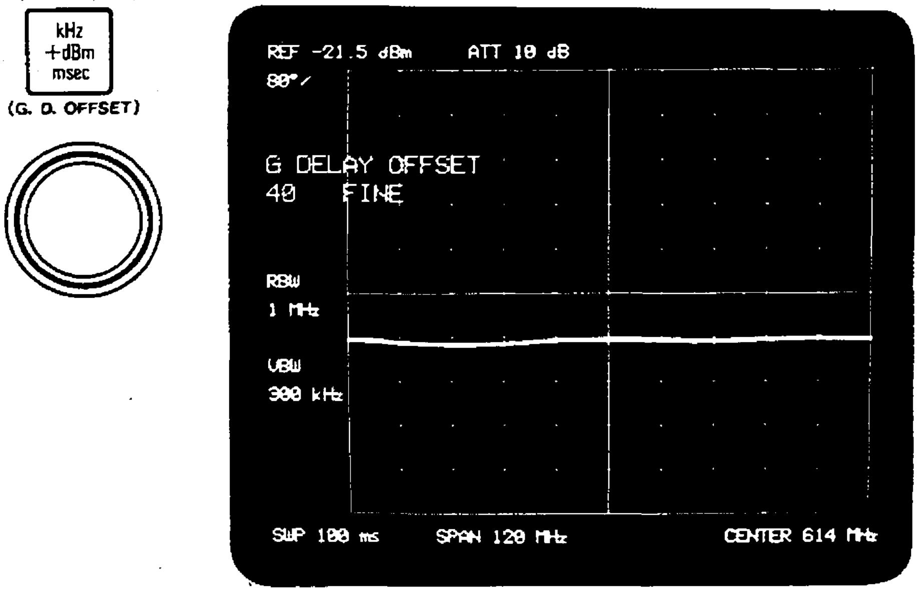


Fig. 6-3 Electrical length fine adjustment

⑧ Next press the MHz (PHASE OFFSET) key to activate phase offset, then position the phase response trace at the center of the vertical graticule.

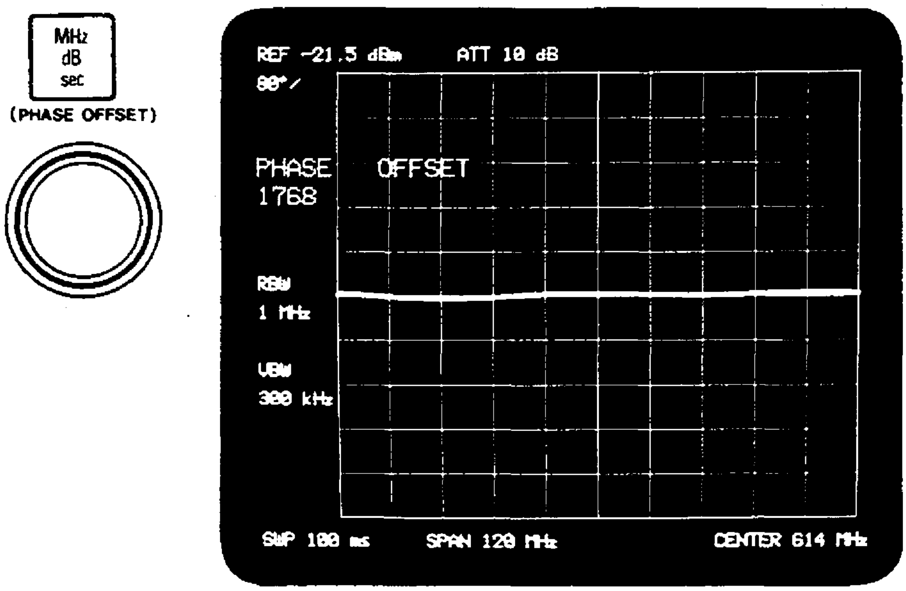
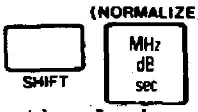


Fig. 6-4 Null phase offset

Verify that a straight line comes to the center of the vertical graticule as shown in Figure 6-4. If the line is not straight, activate a display line, position it to the center of the vertical scale, and press 

to normalize the frequency response.

(9) Connect the device under test to the measuring setup, then press the PHASE key to start phase measurement for the device itself. Operation of the PHASE key will activate phase resolution. Using the DATA knob or DATA step keys, set phase resolution to the appropriate level.

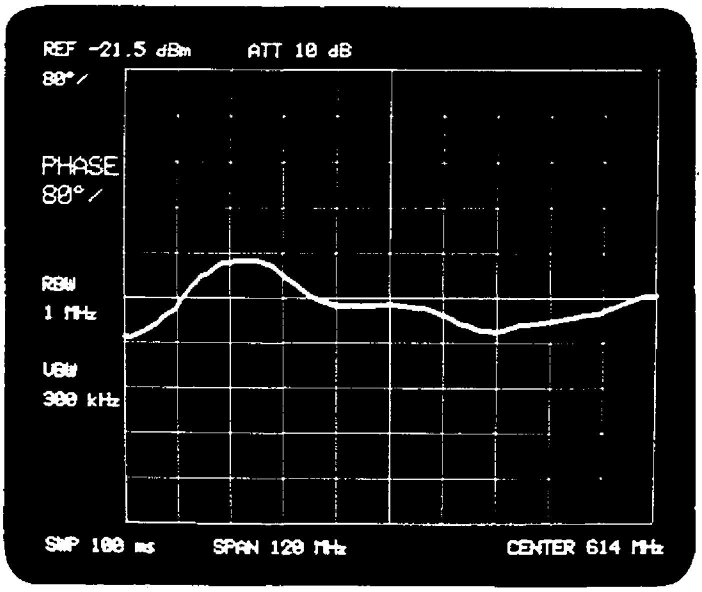


Fig. 6-5 Phase measurement

Note that a higher phase resolution may cause an overflow if the device under test has a relatively large phase rotation.
To observe phase variation, press the (G.D. OFFSET) key and then adjust the electrical length and phase response with the DATA knob. Press the PHASE key again. The phase variation is now enlarged on the display.

6-2. PHASE AND AMPLITUDE ALTERNATE SWEEP (SHIFT, H)

SHIFT D.T.A.P. H performs phase and amplitude measurements alternately and writes the results into trace memories B and A respectively and then transfers it to the display.

When this mode is selected, the indicator lamps on the WRITE A, WRITE B, PHASE, and NORMAL keys light.

To disable alternate sweep press SHIFT D.T.OFF U HOLD .

The alternate sweep should not be activated when frequency response compensation using a display line in Section 5 is used.

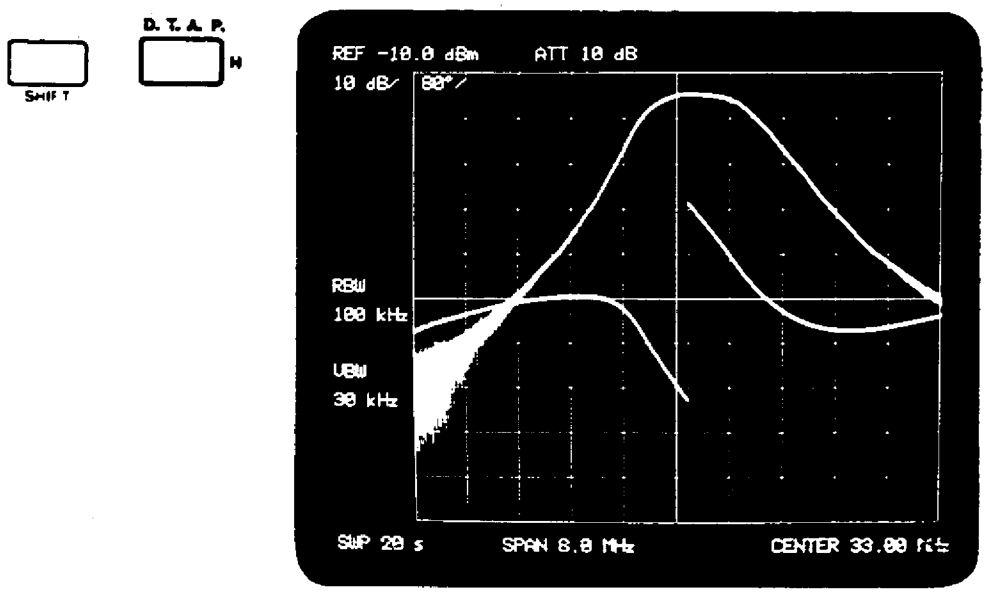


Fig. 6-6 Phase and amplitude alternate sweep

6-3. SAW FILTER PHASE RESPONSE MEASUREMENT

6-3-1. Connecting a Saw Filter to the TR4172

(1) As shown in Figure 6-7, insert a DUT (filter) between the TR4172 TRACKING GENERATOR OUTPUT connector and the INPUT connector. This state of connection is called a. The state of the two connectors being kept through with the DUT removed is called b.

(2) In general, various types of SAW filter are available with input/output impedance of 50 Ω, 75 Ω, 200 Ω, 300 Ω, 1kΩ, and more than 1 kΩ. Before measurement, use an appropriate measure to obtain impedance matching between the SAW filter and the instrument. A schematic diagram of the recommended matching network can be obtained from the manufacturer of the filter.

(3) A saw filter usually has a 20 dB insertion loss. To compensate for this loss, some filters contain an amplifier. If a filter with a self-contained amplifier is to be used, note the maximum output level of the tracking generator.

(4) Use the shortest possible cables.

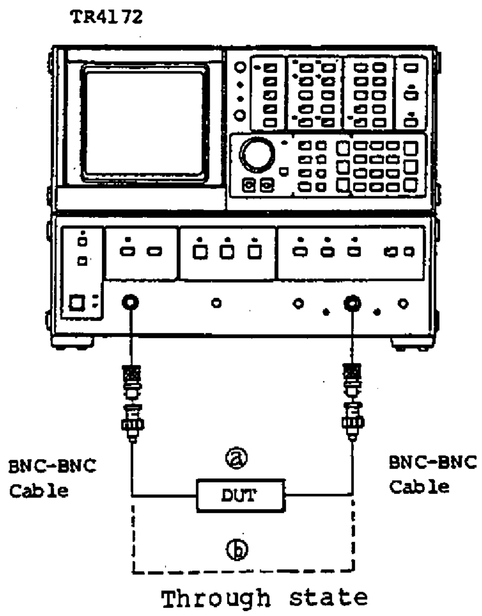


Fig. 6-7 Measuring system setup

6-3-2. Measuring Procedure

① Set up the center frequency, sweep span, input condition, and other necessary parameters.

② Remove the DUT from the connection cable to place the TR4172 TRACKING GENERATOR OUTPUT connector and the INPUT connector in a through state as indicated by ⓑ in Figure 6-7.

③ Press the kHz (G.D. OFFSET) key to obtain a flat phase response. If fine adjustment is required, press the kHz key again to select the G.D. OFFSET FINE mode and perform fine adjustment.

④ Press the MHz (G.D. OFFSET) key to position the phase response trace to the center of the vertical scale.

⑤ Connect a filter in the through state as indicated by ⓐ in Figure 6-7, then press the PHASE key; the phase response of the DUT (filter) will be displayed. Display resolution can be increased with the DATA knob or DATA step keys (80, 40, 20, 8, ... 0.2 deg/div.).

Figures 6-8 and 6-9 show respectively the amplitude and phase responses of the same filter.

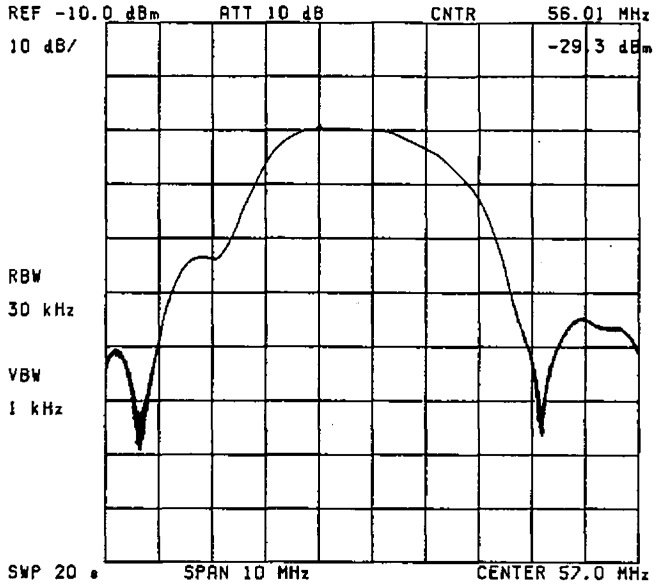


Fig. 6-8 Amplitude response of a filter

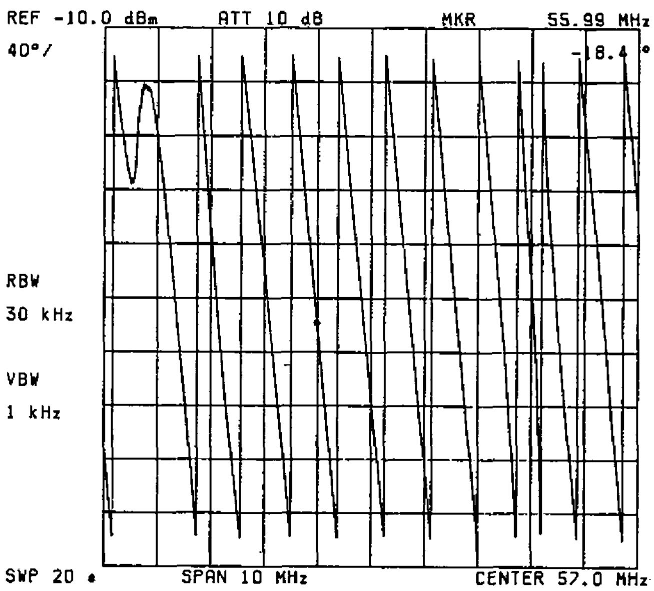


Fig. 6-9 Phase response of the filter

6-3-3. Phase Display Example

Figure 6-10 shows a phase response display example for a saw filter covering a frequency range between 50 and 60 MHz.

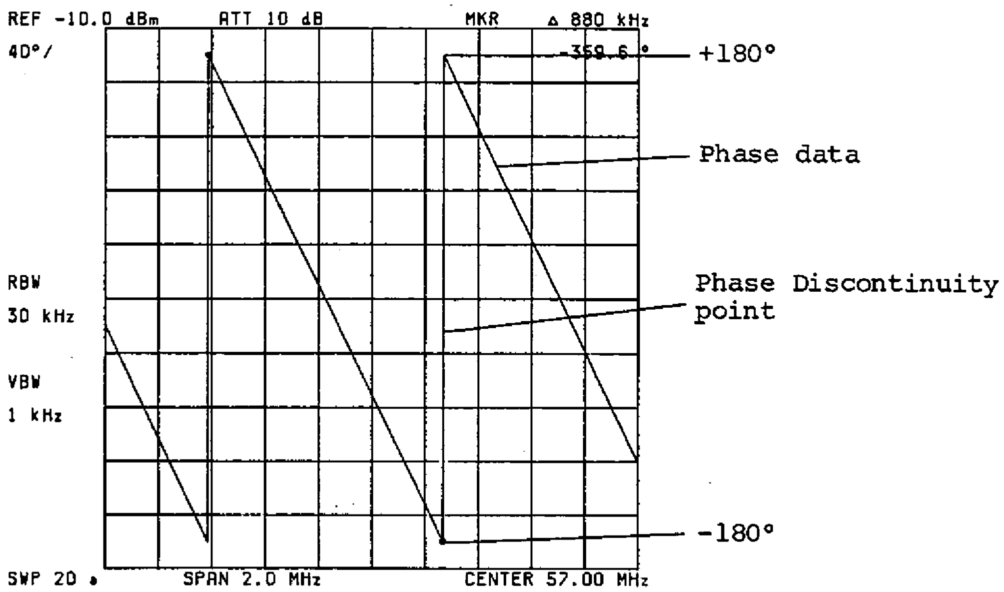


Fig. 6-10 Phase response display example

(1) The example shows that the phase lag increases with frequency.

(2) The vertical lines indicate discontinuity points on the response occurring at $+180^{\circ}$ and -180°.

(3) The center horizontal line (5 div. lines from the top graticule) indicates the zero phase.

(4) Numeric readouts indicate measurement conditions.

(5) This example shows the the filter has a phase lag of about 360° over about a 880 kHz frequency band. For more precise measurement, use the delta marker mode.

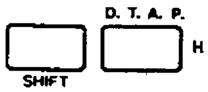
6-3-4. Usage of the Alternate Sweep

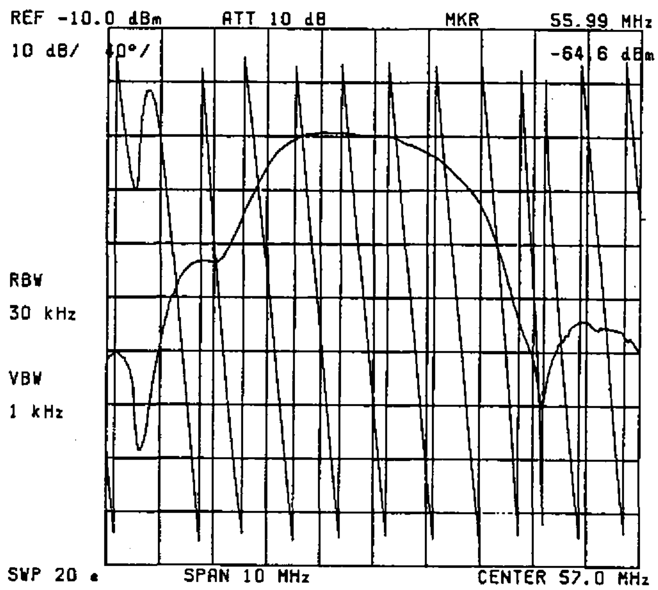
(1) Connect DUT to the instrument. Press the NORMAL key and measure the amplitude response of the DUT to set up necessary measurement conditions.

(2) According to the procedure in 6-3-2, adjust electrical length and determine phase resolution.

(3) Use the DATA knob to select the shortest sweep time which does not affect the phase data.

(4) To obtain the amplitude and phase responses at the same time on the display, press [SHIFT] [D. T. A. P.] H.





(5) To restore the normal measurement mode, press [SHIFT] [D. T. OFF] U. This will place one of trace memories A and B in the write mode and the other in the view mode. To clear unnecessary information, place one of the trace memories in the write mode, and the other in the blank mode.

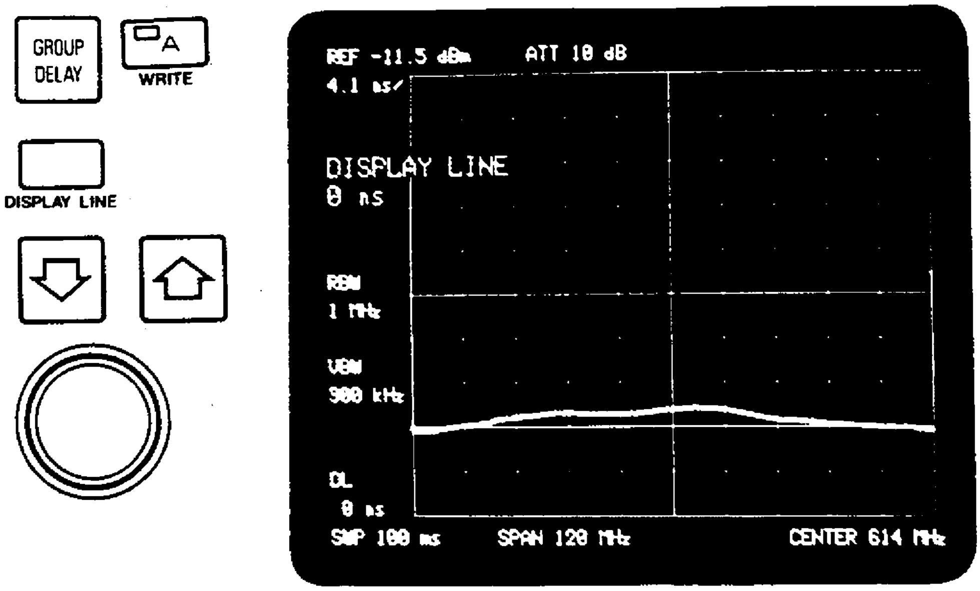
MEMO

SECTION 7
GROUP DELAY MEASUREMENT

7-1. GROUP DELAY MEASUREMENT PROCEDURE

This pharagraph describes group delay measurement procedure for amplifiers or filters.

1. Connect the TRACKING GENERATOR OUTPUT to the input of the device under test (filter or amplifier) and connect the output of the device to the INPUT connector of the analyzer.
2. Press the T.G. key to activate the tracking generator.
3. Press the NORMAL key to measure the pass-band response of the device under test. According to the measurement result, select the appropriate T.G. level and INPUT ATT. level.
4. The group delay response of the device under test can be observed by pressing the GROUP DELAY key. The display will also present delay time per vertical division as XX ns/ (or ps/ or ms/) in the top left display area.
5. For more precise group delay measurement without the affect of the group delay of the measuring system itself, press the WRITE A key to write the group delay response of the measuring system into trace memory A.
6. Then press the DISPLAY LINE key to activate a display line on the CRT, and use the DATA step keys and DATA knob to position the display line as close to the group delay response trace as possible.



⑦ To clear the group delay of the measuring system press [SHIFT] [(NORMALIZE) MHz dB sec].

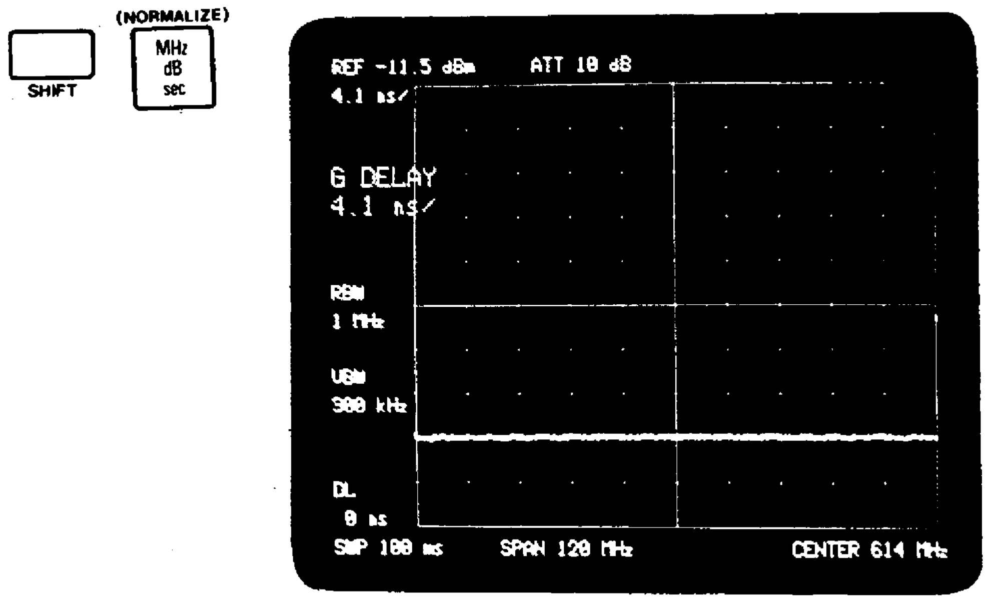


Fig. 7-1 Clearing the measurement system group delay

To cancel this group delay clear mode, press [SHIFT] [(OFF) A-B→A].

⑧ For still more precise measurement of group delay, use averaging. (See 4-14-1.)

After pressing the WRITE A key in step ⑤ above, press the SHIFT and k (AVG. ON) keys to initiate averaging.

When the programmed number of averagings is reached, follow steps

(6) and (7) above, then press the SHIFT and m (AVG. OFF) keys to disable averaging.

(9) To obtain a higher resolution in group delay measurement, press the GROUP DELAY key to activate resolution.
Group delay resolution can be increased by turning the DATA knob clockwise or operating the UP DATA step key. The DATA keyboard is not available for resolution control.
A too high resolution can cause overflow. If overflow occurs, press the G.D. OFFSET key to activate the electrical length and then adjust the electrical length with the DATA knob or DATA step keys to add offset to the group delay.

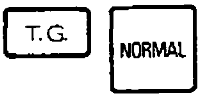
(10) During group delay measurement, press the PHASE key from time to time to check the phase response for overflow. Group delay will be indefinite on the overflow.
If phase rotation is observed, press the (G.D. OFFSET) key and adjust group delay offset with the DATA knob or DATA step key until phase rotation is eliminated.

(11) If high-resolution measurement suffers from poor signal-to-noise ratio, press the VIDEO BW key to narrow the video bandwidth. For group delay measurement, manually select a relatively long sweep time, do not use AUTO mode.

7-2. GROUP DELAY MEASUREMENT EXAMPLE

This provides a group delay measurement example using a filter as the device under test.

(1) Connect the TRACKING GENERATOR OUTPUT to the input of the device under test and connect the output of the device to the INPUT -1 of the analyzer.



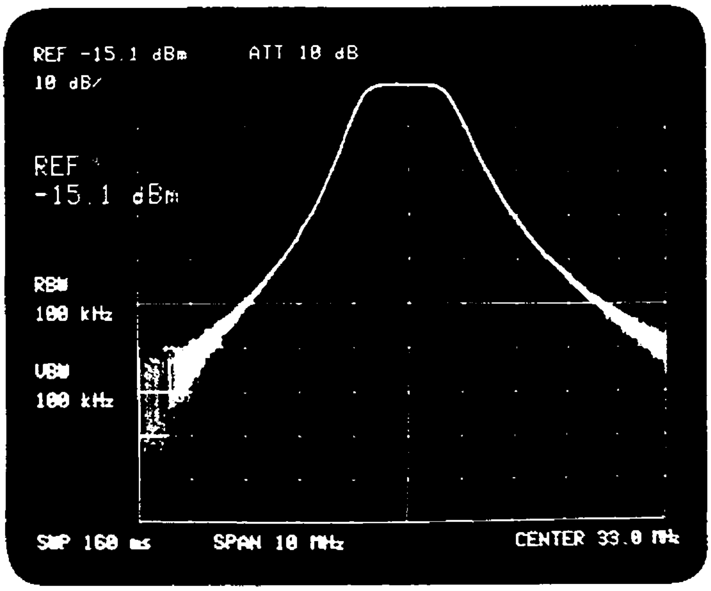


Fig. 7-2 Normal mode signal response

2. Press the T.G. key to activate the tracking generator.
3. Press the NORMAL key to measure the pass band response of the device under test. According to the measurement result select the appropriate T.G. level and INPUT ATT. level (Figure 7-2).
4. Disconnect the device under test from the measuring setup and connect the input and output cables using an inline plug adapter to check the through frequency response.
5. The through phase response can be observed by pressing the PHASE key (Figure 7-3).

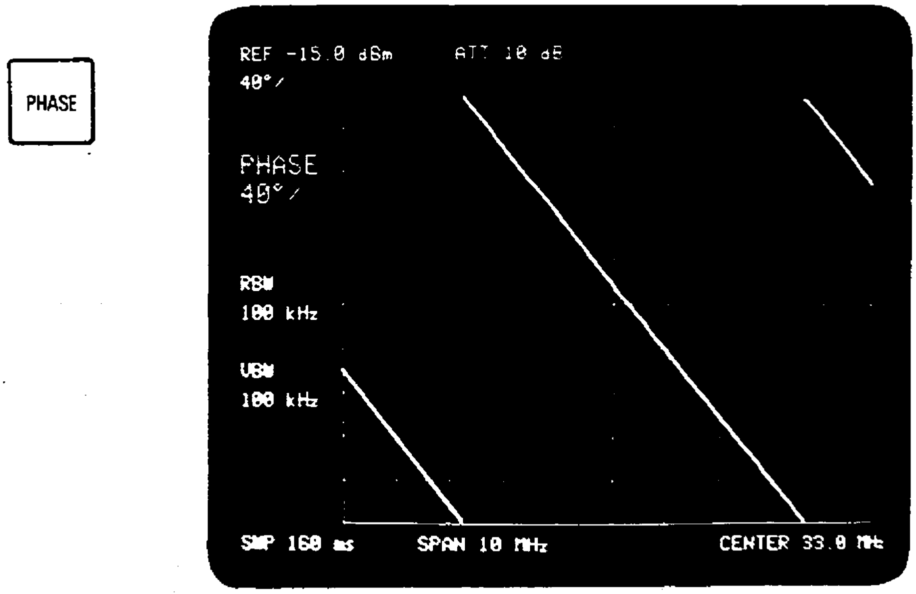


Fig. 7-3 Through phase response

⑥ If phase rotation is observed, press the [G.D. OFFSET] key to activate the electrical length. Then adjust the phase response to flat with the DATA knob or DATA step keys (Figure 7-4).

If the 

key is pressed under these setup, group delay offset value is set to 0 ps. Consequently, when group delay value at marker point is to be displayed, the value adding subsequently entered group delay offset is displayed at the active function area on the left side of CRT.

⑦ Next press the (PHASE OFFSET) key to enable entry of phase offset. Position the phase response trace to the center of the vertical graticule with the DATA knob or DATA step keys (Figure 7-5).

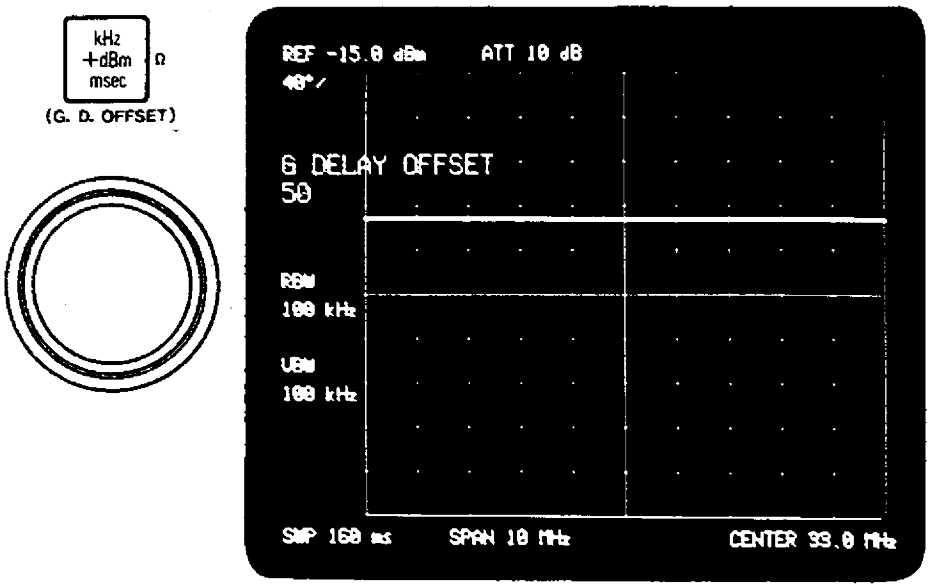
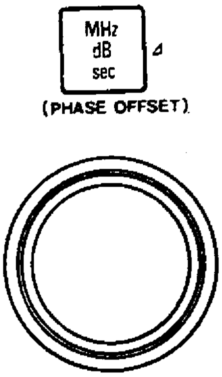


Fig. 7-4 Elimination of phase rotation



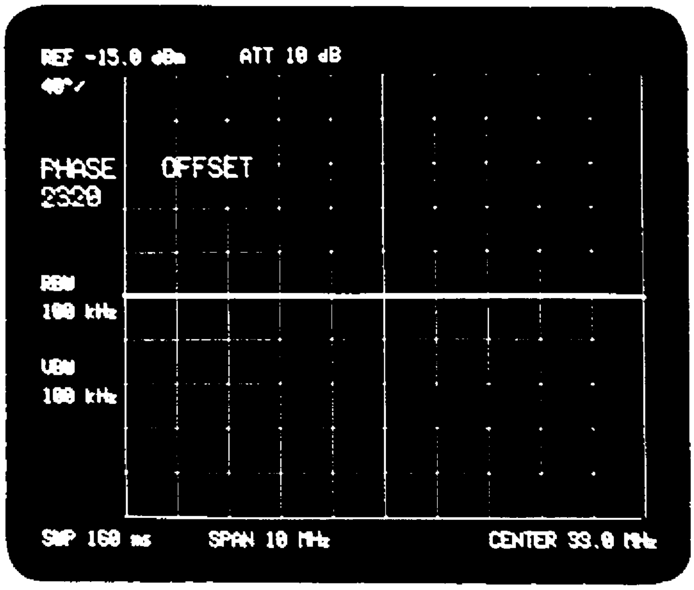


Fig. 7-5 Positioning the phase response trace to the center of the vertical graticule

⑧ Connect the device under test (filter) to the measuring setup to observe its phase response (Figure 7-6).

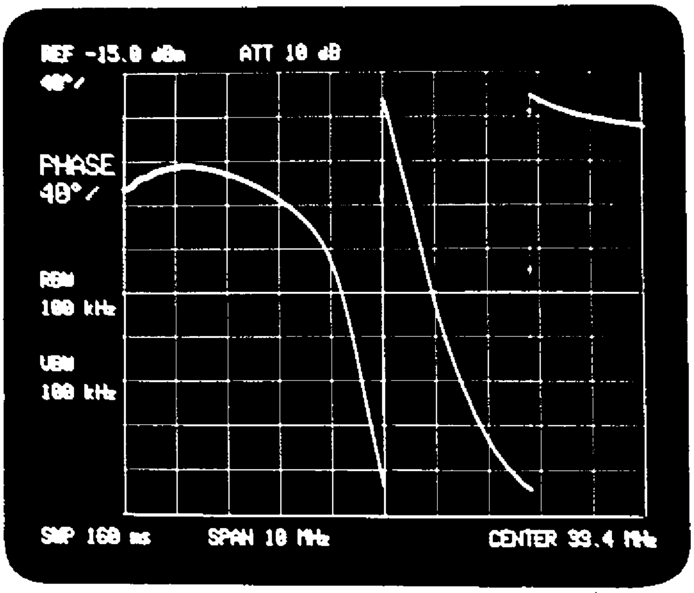


Fig. 7-6 Filter's phase response

⑨ The group delay of the filter can be observed by pressing the GROUP DELAY key (Figure 7-7).

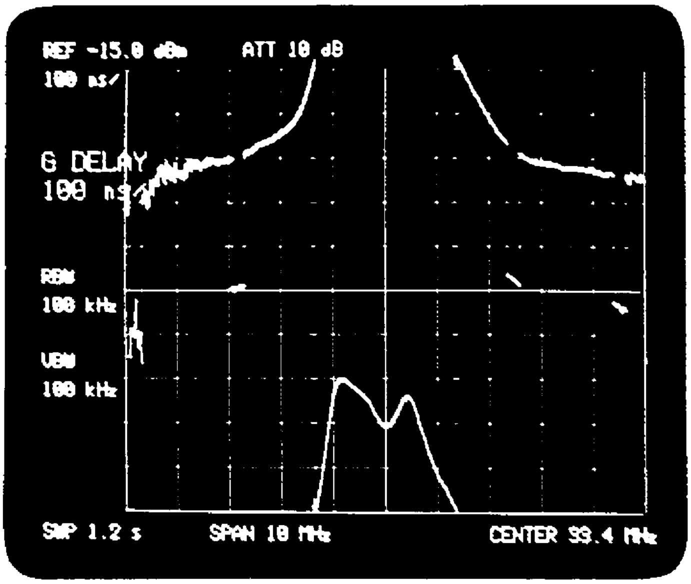
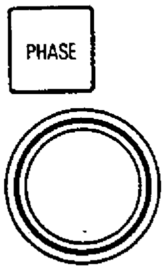


Fig. 7-7 Group delay measurement

⑩ To obtain higher resolution for group delay measurement, resolution for phase measurement must be increased.
Press the PHASE key to activate phase. To increase phase resolution turn the DATA knob clockwise.
The phase readout ($XX^{o}/$) in the active function display area will increase (Figure 7-8).



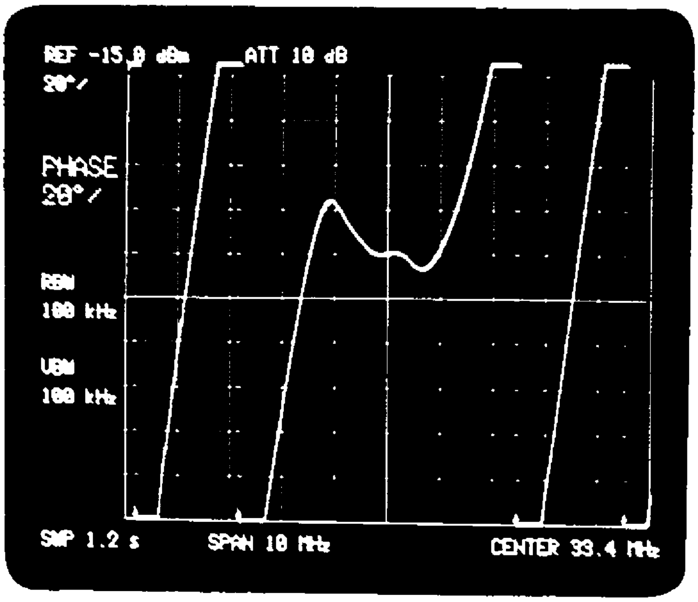


Fig. 7-8 Increasing phase resolution

⑪ If phase overflow occurs in the pass band due to the increased phase resolution, press the (G.D. OFFSET) key to activate group delay offset. Then adjust the phase slope in the pass bandwidth with the DATA knob.

⑫ The group delay of the device under test can be observed by pressing the GROUP DELAY key (Figure 7-9).

⑬ For more precise group delay measurement, write the group delay of the through response into trace memory A at the same resolution (See 7-1 (5), (6)), bring the display line close to the through response trace, then press the SHIFT and MHz keys to eliminate the the group delay of the measuring system itself. Use of the averaging mode (See 7-1 (8)) will provide still more precise measurement.

⑭ If a greater signal-to-noise ratio is desired, press the VIDEO BW key to narrow the video bandwidth. At this time press the SWEEP TIME key and select a relatively long sweep time.

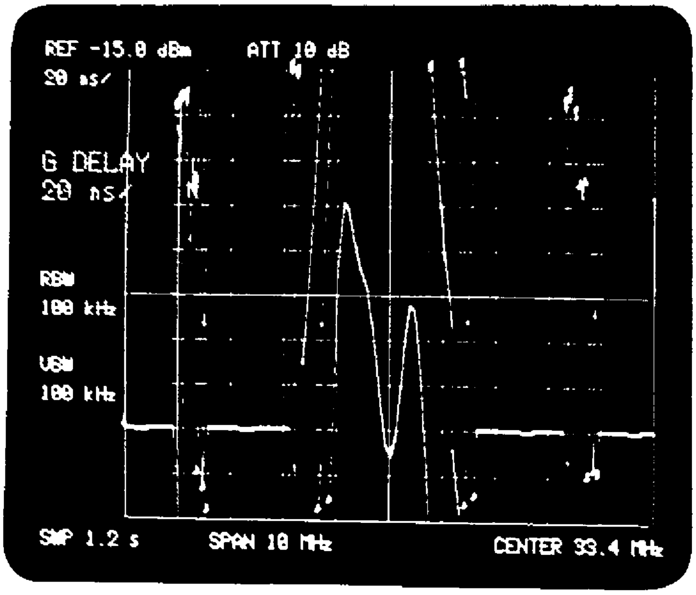


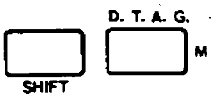
Fig. 7-9 Group delay measurement

A much greater signal-to-noise ratio will be obtained by selecting the averaging mode (press SHIFT and AVG. ON.) after connecting the device under test.

7-3. GROUP DELAY AND AMPLITUDE ALTERNATE SWEEP (SHIFT, M)

SHIFT,M performs group delay and amplitude measurements alternately. The results are written into memories B and A respectively and then transferred to the display simultaneously. The indicator lamps on the GROUP DELAY, NORMAL, WRITE A, and WRITE B keys will light.
To disable the alternate sweep mode press the SHIFT and ␣ keys.
The group delay and amplitude alternate sweep mode is usable together with the frequency response compensation mode (page 7-1) using the SHIFT and MHz keys. Followings are the measurement procedure example using a filter as the device under test.

1. Connect the TRACKING GENERATOR OUTPUT to the device under test (filter or amplifier) and connect the output of the device to the INPUT-1 connector of the analyzer.
2. Press the T.G. key to activate the tracking generator.
3. Press the NORMAL key to measure the frequency response, and select appropriate T.G. level and INPUT ATT. level.
4. Disconnect the device under test from the measuring setup and connect the input and output cables to check the through frequency response.
5. Press the DISPLAY LINE key to activate display line on the CRT, and use the DATA step keys and DATA knob to position the display line as close to the through frequency response as possible.
6. Press the SHIFT and M keys to specify group delay and amplitude alternate sweep mode.
7. If the SHIFT and MHz keys are pressed at this time, both response traces of amplitude and group delay are normalized. In this case, amplitude response trace is normalized on the display line and group delay response trace is normalized on the second lowest graticule line of the CRT, respectively.
8. Observe the device response traces of amplitude and group delay simultaneously.



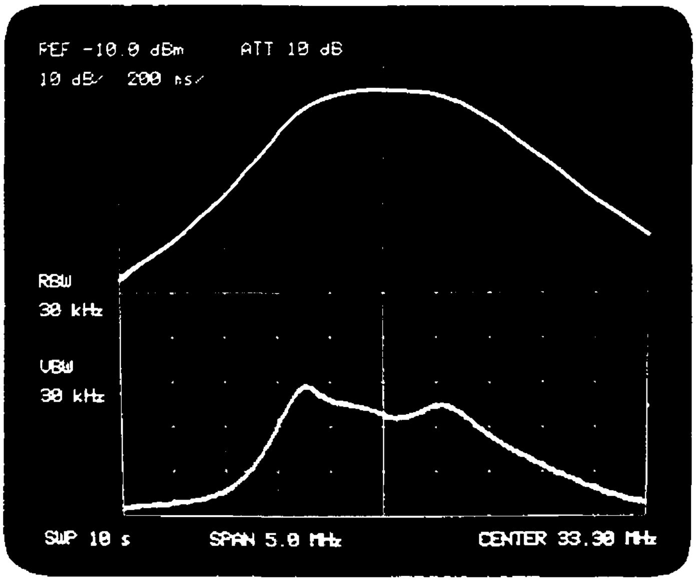


Fig. 7-10 Group delay and amplitude alternate sweep

7-4. APERTURE CONTROL

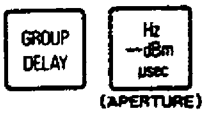
In general, a higher group delay resolution can cause lower signal-to-noise ratio. However, group delay resolution can be increased without sacrificing S/N ratio by increasing aperture. Aperture means ΔF in the group delay equation $\Delta\theta/\Delta F$.

On the TR4172, aperture is normally set up as follows:

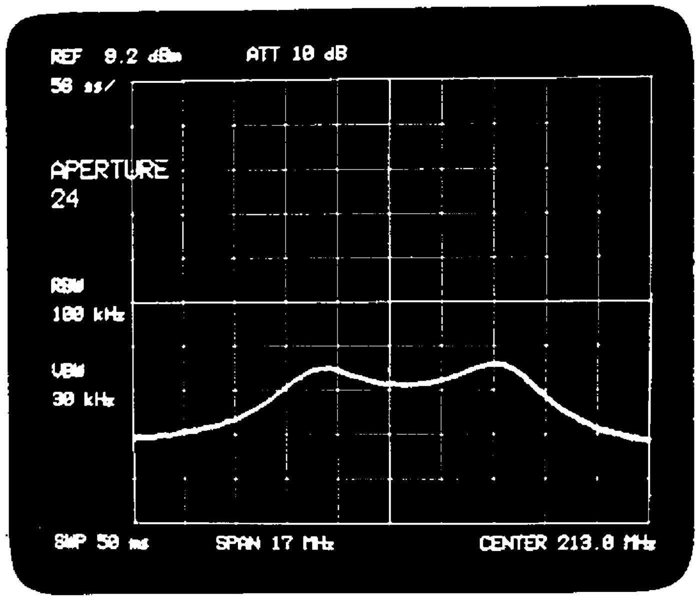
$$\Delta F = \frac{24}{1000} \times \text{frequency span}$$

Constant 24/1000 in the above formula can be increased up to 192/1000 at four steps as follows:

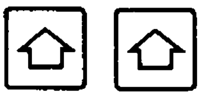
1. Operation of the GROUP DELAY and Hz keys will activate the aperture. APERTURE 24 will be shown in the active function display area on the CRT to indicate that the current aperture is $\frac{24}{1000}$ x (frequency span).
2. Select the appropriate aperture from 24, 48, 96, or 192 with the DATA knob or DATA step keys. The numeric data keyboard is not usable for aperture selection.
   Once aperture is increased, resolution can be increased without sacrificing S/N ratio.
   For example, if the resolution is 100 ns/div. with the aperture 24/1000, the resolution can be increased to 50 ns/div. by changing the aperture to 48/1000.
3. As the aperture is increased, the effective range of the screen graticule is gradually reduced accordingly.
   This is because (aperture/2 - 12) points out of 1001 points on the frequency axis are lost at both side ends of the graticule as aperture is increased.
   When aperture is increased to 192, the effective range of the graticule is lessened by one division on each end of the graticule.
4. Operation of the GROUP DELAY key will clear the active aperture mode and restore the active group-delay resolution mode.

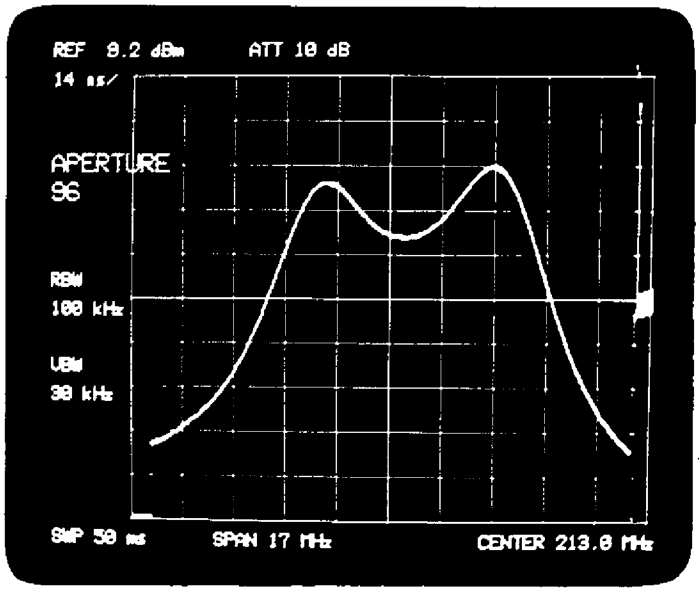


GROUP DELAY
Hz
—dBm
µsec
(APERTURE)



REF 0.2 dBm
ATT 10 dB
50 ns/
APERTURE
24
RBW
100 kHz
VBW
30 kHz
SWP 50 ms
SPAN 17 MHz
CENTER 213.0 MHz





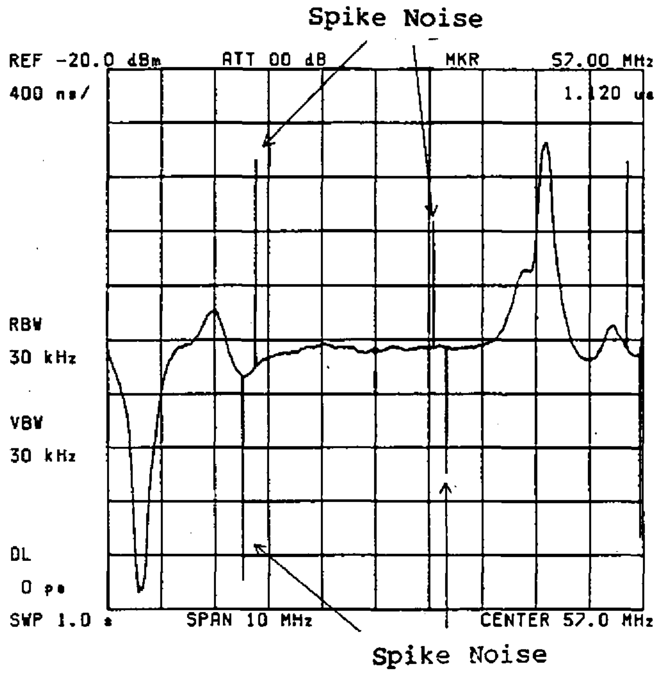
REF 0.2 dBm
ATT 10 dB
14 ns/
APERTURE
96
RBW
100 kHz
VBW
30 kHz
SWP 50 ms
SPAN 17 MHz
CENTER 213.0 MHz

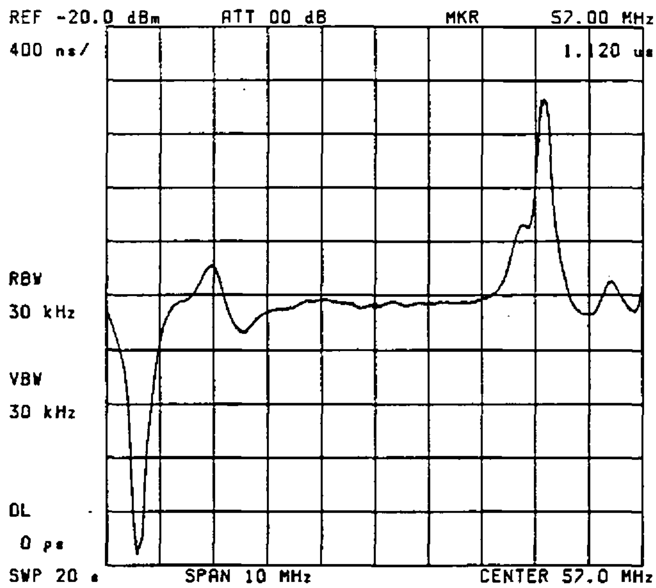
During group delay measurement, the signal response trace on the display may produce spike noise as shown below.

To eliminate this noise, either of the following methods may be used:

(1) Select a sufficiently long sweep time.

(2) Perform electrical length correction to eliminate discontinuity of the phase response. Now the ripple of relative group delay is measured. Note that an absolute delay time cannot be measured.





MEMO

SECTION 8

ATTACHMENT TO GPIB AND PROGRAMMING SUPPORT

8-1. INTRODUCTION

The TR4172 Spectrum Analyzer is attached to the GPIB (specified in IEEE Standard 488-1978) via the GPIB interface (standard supply). This section describes the specifications and operations of the GPIB interface.

* GPIB: General Purpose Interface Bus

8-2. GPIB OVERVIEW

GPIB enables interfacing of a measuring instrument with its controller or other peripheral devices through simple cabling (bus line).
Compared with other interfacing methods, GPIB provides better expansibility, operability and compatibility with other products both electrically and mechanically, thus enabling construction of various grades of instrumentation systems through a single bus cabling.
In a GPIB system, each system device on the bus must have its own address. Each device can be designated for one or two functions out of controller, talker, and listener functions. During system operation, only one talker may send data on the bus, while one of more listeners can receive the data.
The controller designates talker and listener addresses to cause the talker to send data to the listener or cause itself (talker) to send measurement condition data, etc. to the listener.
System devices are linked together with asynchronous, bidirectional bus (8 data lines), through which bit parallel, byte serial data is transferred. Due to its asynchronous nature, the bus permits attachment of both high-speed and low-speed devices at a time.
Data transferred between devices includes measurement data, measurement conditions (programs), or commands all in ASCII character format.
In addition to the 8 data lines, GPIB includes three handshake lines to control asynchronous data flow between devices and five control lines to control information flow on the data bus.

The handshake lines transfer the following signals:

Data Valid (DAV): Indicates validity of transferred data.

Not Ready For Data (NRFD): Indicates data receive not ready state.

Not Data Accepted (NDAC): Indicates the data receive completion state.

The control lines transfer the following signals:

Attention (ATN): Used to discriminate address or command data on the data bus from other information.

Interface Clear (IFC): Clears the interface.

End or Identify (EOI): Indicates the end of data transfer.

Service Request (SRQ): Used by any device to request the controller for service.

Remote Enable (REN): Used to place a remote programmable device in the remote control mode.

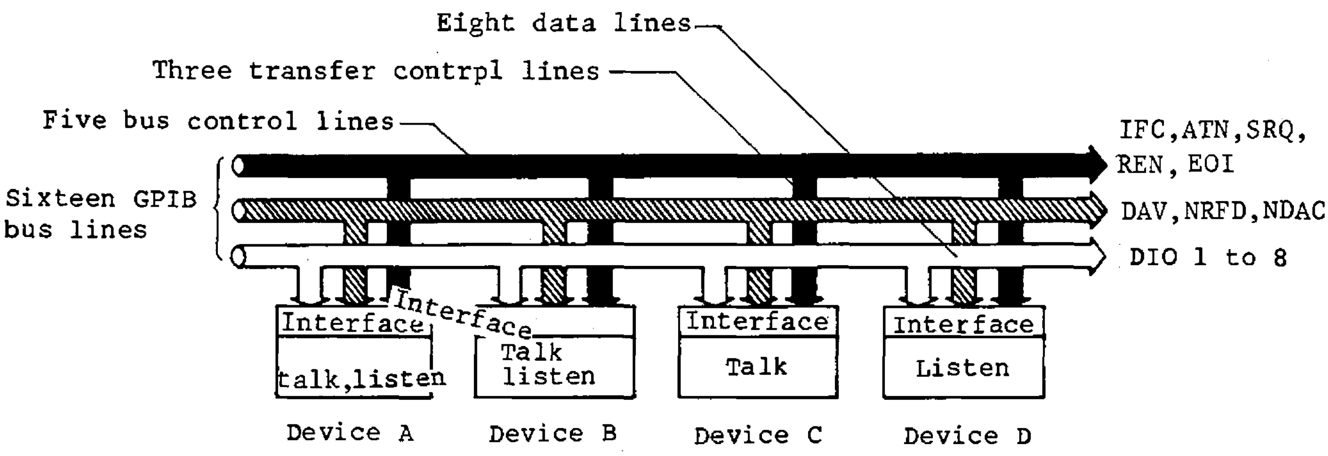


Fig. 8-1 Concept of GPIB

8-3. SPECIFICATIONS

8-3-1. GPIB Specifications

Standard	: IEEE Standard 488-1978
Code	: ASCII (binary code with packed format)
Logical levels	: 0 (HIGH): +2.4 V or more
	1 (LOW) : +0.4 V or less
Signal line termination	: 16 bus lines terminated as shown below:

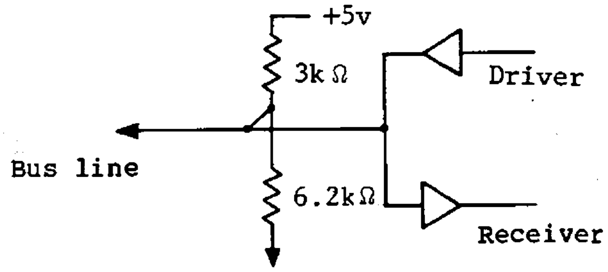


Fig. 8-2 Signal line termination

Driver	: Open collector output LOW output: +0.4 V or less, 48 mA HIGH output: +2.4 V or more, -5.2 mA
Receiver	: LOW at +0.6 V or less HIGH at +2.0 V or more
Bus cable length	: Total bus cable length should be less than 2 meters x (number of attached devices) and must not exceed 20 meters.
Address designation:	Up to 31 talker and listener addresses can be designated with the rear ADDRESS switch. After address setting, operation of the MASTER RESET key is required.
Connector	: 24 pin GPIB connector 57-20240-D35A (Amphenor or equivalent)

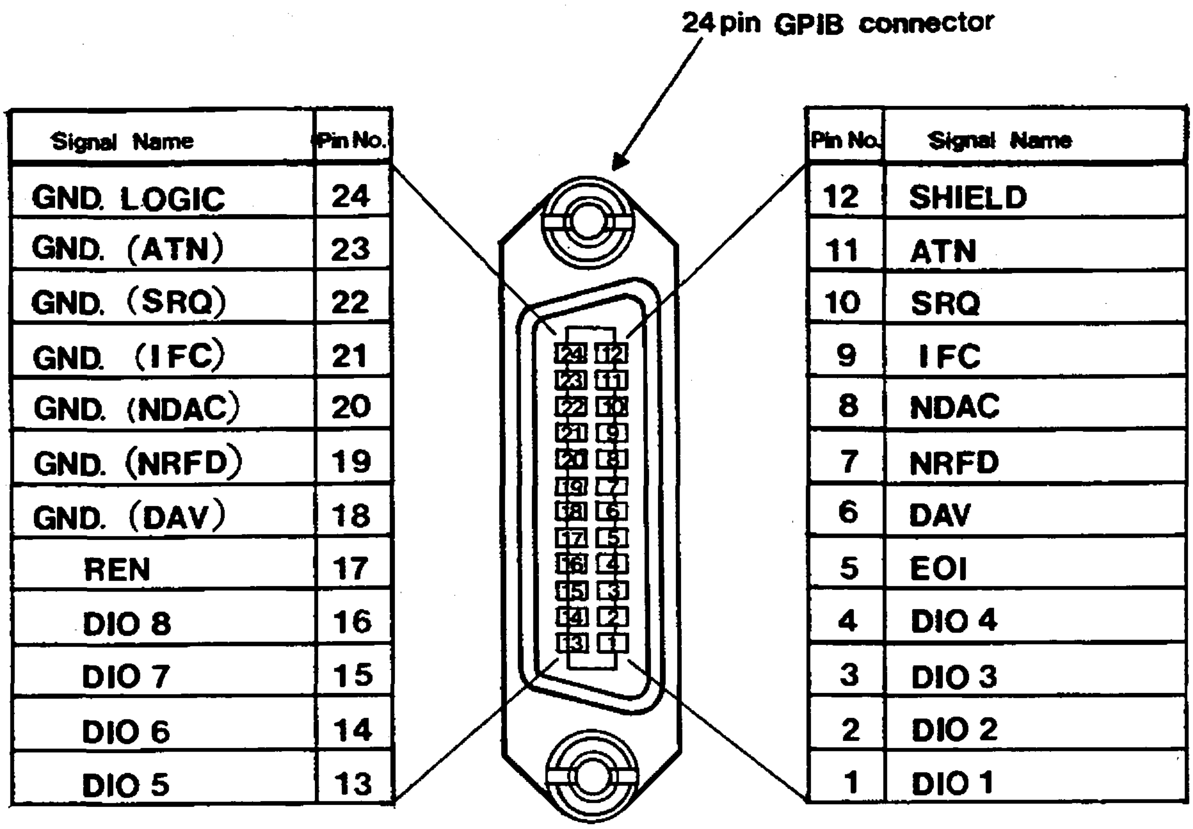


Fig. 8-3 GPIB connector pin assignments

8-3-2. Interface Functions

Table 8-1 Interface functions

Code	Function
SH1	Source handshake
AH1	Accepter handshake
T6	Basic talker, serial poll Unaddressed to talk if addressed to listen.
L4	Basic listener function Unaddressed to listen if addressed to talk.
SR1	Service request
RL1	Remote function
PP0	No parallel poll function available.
DC1	Device clear
DT0	No device trigger function available.
C0	No controller function available.
E1	Open collector bus driver. EOI and DAV are E2 (three-state bus driver).

8-4. GPIB HANDLING OPERATION

8-4-1. Device Attachment

The GPIB system consists of multiple bus devices.

The following points should be noted:

(1) Before making interconnections between the TR4172, controller, and peripheral devices, check the status and operation of each device.

(2) The length of interconnecting and bus cables should be the necessary minimum. The total length of the bus cable should be 2 meters x (number of bus devices) and must not exceed 20 meters.
The following standard bus cables are available from ADVANTEST :

TR4172 spectrum analyzer complies with FCC radiation specification. Use of the following connecting cables is suggested to construct a GPIB system with the TR4172 spectrum analyzer.

Table 8-2 Standard bus cable (Accessories available)

Length	Model Name	Stock No.
0.5 m	408JE-1P5	DCB-SS1076 x 01
1 m	408JE-101	DCB-SS1076 x 02
2 m	408JE-102	DCB-SS1076 x 03
4 m	408JE-104	DCB-SS1076 x 04

(3) Bus cable connectors are of "piggy-back" type with both male and female plugs combined for each connector; stacked use of up to three connectors is possible.
After cable connectors are plugged to their mating receptacles, secure them with connector retention screws.

(4) Before powering each device, carefully check their power supply conditions, grounding and necessary settings. All devices attached to the bus must be turned on. If any one of the devices is left turned off, correct system operation will not be guaranteed.

8-4-2. Setting the GPIB address

The TR4172 rear panel contains a DIP switch as shown in Figure 8-4. This switch is used to set the GPIB address of the TR4172.

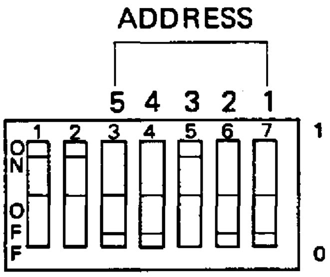


Fig. 8-4 ADDRESS switch

The GPIB address can be set by setting the bit 1-5 positions of the ADDRESS switch to 0 or 1. Table 8-4 gives the correspondence between the switch settings and addresses.

NOTE

Whenever the ADDRESS switch has been set, be sure to press the MASTER RESET key to clear the TR4172 GPIB interface temporarily.

8-5. Programming

The TR4172 allows a GPIB controller to set all its functions in remote mode. Sample programs developed with the HP Series 200 computer and TR4511 option controller are shown below.

Example : Set a center frequency of 50 MHz, a frequency span of 500 kHz, and a reference level of -10 dBm.

HP Series 200 computer

```
OUTPUT 7 01 ; "CF 50MZ SP 500KZ RE 10MD"
```

Designate the controller as talker. (OUTPUT)

Selects the GPIB interface. (7)

GPIB address of the TR4172 (01)

Center frequency (CF)

Set 50 MHz (50MZ)

Frequency span (SP)

Set 500 kHz. (500KZ)

Reference level (RE)

Set -10 dBm. (10MD)

TR4511 option controller

```
OUTPUT 1 : "CF 50MZ SP 500KZ RE 10MD"
```

Designate the controller as talker. (OUTPUT)

GPIB address of the TR4172 (1)

See the sample program for the HP Series 200 computer above. ("CF 50MZ SP 500KZ RE 10MD")

The codes, such as CF, MZ, and SP, used in the sample programs are GPIB commands associated with the TR4172 panel keys.

You can proceed with programming in the same way as you would press panel keys. Figure 8-5 shows a conceptual view of the flow of panel key operations. The first step in the flow is selecting a function, then entering data and a termination.

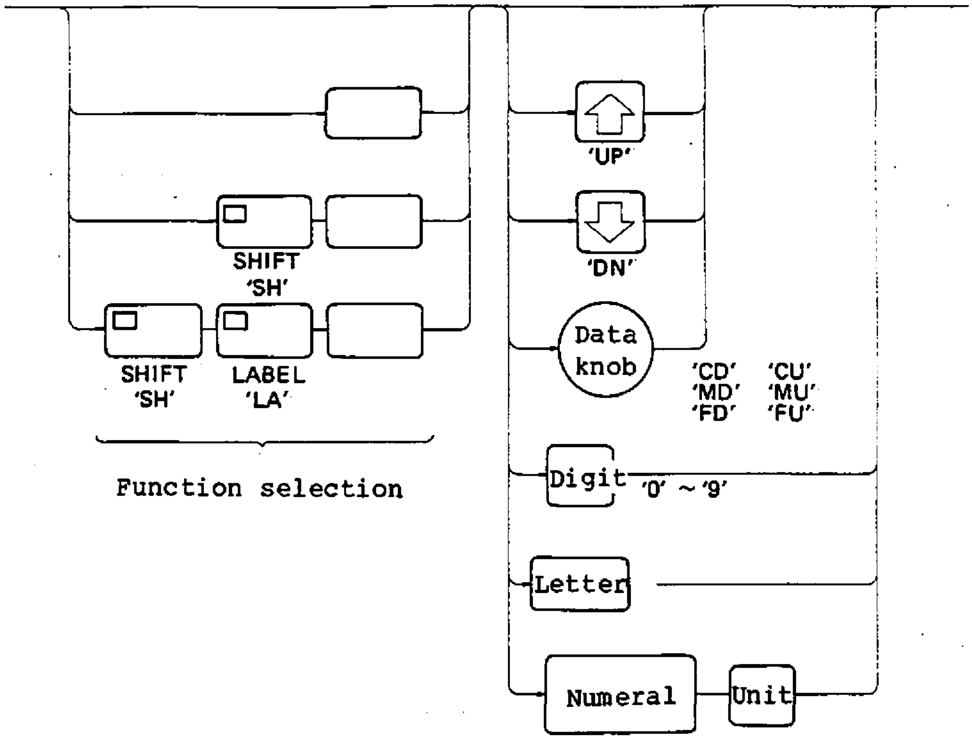


Figure 8-5 Panel key operation flow

To execute shift and double-shift key functions, enter SH and SHLA followed by the codes associated with the panel keys, respectively. The UP, DN, digit (0-9), . and letter (uppercase ASCII coded) keys can be used as data keys. To enter letters, enter the program codes associated with the panel keys. As unit keys, MZ, KZ, HZ, DB, DP, DM, SC, MS, and US are available.

Data knobs can be set both clockwise and counterclockwise in the same way as other keys. CU, MU, and PU are assigned as clockwise data knobs; CD, MD, and FD are assigned as counterclockwise data knobs. The assignment of the three data knobs in each direction permits setting three levels of data to vary (COARSE, MEDIUM, and FINE). The clockwise data knobs, CU, MU, and FU, and the counterclockwise data knobs, CD, MD, and FD, represent COARSE, MEDIUM, and FINE, respectively.

This variable data level function does not work with all of the TR4172 functions. The TR4172 functions for which data levels can be varied are: CENTER FREQ., FREQ. SPAN, START FREQ., STOP FREQ., REF LEVEL, PHASE OFFSET, GROUP DELAY OFFSET, GROUP DELAY OFFSET FINE, APERTURE, MARKER, MARKER, and DISPLAY LINE.

NOTE

Use uppercase ASCII coded letters for programming any TR4172 functions. Lowercase letters and spaces are ignored. Further, any code other than the codes defined in Table 8-5 will be ignored when received.

8-6. Data I/O

The following five basic groups of commands and their enhancements allow data to be output from the TR4172 to the GPIB interface:

OA: Outputs active data.

MF: Outputs a marker frequency.

ML: Outputs a marker level.

TO: Outputs TR4172 trace memory data in decimal.

RD: Outputs data from any TR4172 memory location.

The following two basic groups of commands and their enhancements allow data to be input from the GPIB interface to the TR4172:

LD: Inputs data to any TR4172 memory location.

TI: Inputs data to TR4172 trace memory in decimal.

Use these commands selectively to suit specific applications. Detailed instructions on how to use these commands and their formats are described below.

NOTE

While all internal memory locations in the TR4172 are accessible to the GPIB controller, inadvertent writing to spaces other than the memory spaces mentioned below is prohibited. Such writing could cause damage to the system software, because no protection is provided at all.

8-6-1. OA (Output Active Data) command

The OA command causes the TR4172 to output active numeric data when it is designated as talker. With this command, data on any function that can be set active can be output. The active state is indicated by the function name and data being distinctly displayed in the left-side part of the TR4172 screen. The active state can be set by transmitting a function set command to the TR4172 in the same way as

you press panel keys. A sample program demonstrating how to use the OA command to read a center frequency is shown below.

HP Series 200 computer

```
10: DIM A$ [24]
20: OUTPUT 701 ; "CFOA"
30: ENTER 701 ; A$
40: DISP A$
50: END
```

TR4511 option controller

```
10: DIM A$ (24)
20: OUTPUT 1 : "CFOA"
30: ENTER 1 : A$
40: DISP A$
50: END
```

Line number		
HP Series 200	TR4511	Explanation
10	10	Allocates 24 bytes of character string variable A$.
20	20	Activates CENTER FREQ. in the TR4172. Directs the TR4172 to output active data.
30	30	Designates the TR4172 as talker to receive data from. The TR4172 outputs the CENTER FREQ. data since it has been set active.
40	40	Displays the input data (example: 3.5727E + 3 ← 3.5727 kHz).
50	50	Program end

Because the execution of the OA command yields data in numeric form, it may also be programmed in the following way:

HP Series 200 computer

```
10: OUTPUT 701 ; "CFOA"
20: ENTER 701 ; A
30: DISP A
40: END
```

TR4511 option controller

```
10: OUTPUT 1 : "CFOA"
20: ENTER 1 : A
30: DISP A
40: END
```

Line number		Explanation
HP Series 200	TR4511	
10	10	Activates CENTER FREQ. in the TR4172. Directs the TR4172 to output active data.
20	20	Designates the TR4172 as talker to receive data from. The TR4172 outputs the CENTER FREQ. data since it has been set active.
30	30	Displays the input data (example: 3572.7 ← 3.572 kHz).
40	40	Program end

When a marker is set active, the frequency and level at the marker point are displayed in the left-side part of the TR4172 screen as in:

MARKER
50 MHz
-10 dBm

With the OA command, only the frequency data on the second line above can be output. Where two sets of data are active as in this example, only the data on the upper line can be output by the OA command.

OA command output data format

```
␣DDDDDDDDDDD. DDDDDDDDE±DCRLF

                                   (EOI)
                                     └──── Block delimiter
      └Data sign
       (corresponding
       to the TR4172
       screen display)
 └Data mantissa part          └──────── Data exponential part
  (corresponding to
  the TR4172 screen
  display)
```

The maximum byte length of the data is 24 bytes, excluding block delimiters. The array declaration must be 24 bytes at least if data is to be read as a character string variable by using a GPIB controller or similar device. The TR4172 outputs CR and LF as a block delimiter, plus a single-line signal EOI synchronized with the LF byte.

In OA mode, the output data is converted into frequency or time data. Specifically, the output data goes through the following conversion processes:

Hz → E + 0, kHz → E + 3, MHz → E + 6

s → E + 0, ms → E − 3

μs → E − 6, ns → E − 9, ps → E − 12

The data sign and the data mantissa part correspond to the TR4172 screen displays. If data other than frequency and time is output with the OA command, only the data sign, data mantissa part, and block delimiter of the data are output without its unit being converted. If data cannot be decoded as numeric data (example: LIN x 1), only a block delimiter is output without numeric data.

A sample program demonstrating how to read vertical axis scale data, which is neither frequency nor time data, from the TR4172 screen is shown below.

HP Series 200 computer

```
10: DIM A$ [24]
20: OUTPUT 701 ; "SH5OA"
30: ENTER 701 ; A$
40: DISP A$
50: END
```

TR4511 option controller

```
10: DIM A$ (24)
20: OUTPUT 1 : "SH5OA"
30: ENTER 1 : A$
40: DISP A$
50: END
```

Line number		Explanation
HP Series 200	TR4511	
10	10	Allocates 24 bytes of character string variable A$.
20	20	Sets the TR4172 screen vertical axis scale at 0.1 dB/, activating the scale data. Directs the TR4172 to output active data.
30	30	Designates the TR4172 as talker to receive data from. The TR4172 outputs the scale data since it has been set active.
40	40	Displays the input data (example: 0.1 ← 0.1 dB/).
50	50	Program end

Because the data to be output by the TR4172 on line 30 is a screen vertical axis scale of 0.1 dB/, which is neither frequency nor time data, only the numeric value of 0.1 is apparently output with its unit 'dB/' being ignored.

Since all data is output in numeric form in this case as well, line 30 may be reprogrammed to read as follows:

HP Series 200 computer

```
10: OUTPUT 701 ; "SH5OA"
20: ENTER 701 ; A
30: DISP A
40: END
```

TR4511 option controller

```
10: OUTPUT 1 : "SH5OA"
20: ENTER 1 : A
30: DISP A
40: END
```

Line number		Explanation
HP Series 200	TR4511	
10	10	Sets the TR4172 screen vertical axis scale at 0.1 dB/, activating the scale data. Directs the TR4172 to output active data.
20	20	Designates the TR4172 as talker to receive data from. The TR4172 outputs the scale data since it has been set active.
30	30	Displays the input data (example: 0.1 ← 0.1 dB/).
40	40	Program end

NOTE

With the OA command, whether the output data is numeric or not is determined by evaluating character codes individually. Whenever any code other than +, –, 0-9, H, k, M, s, m, μ, n, p, ., ,, /, and ␣ is encountered, the OA command execution terminates with a block limiter output, by abandoning further code conversion into ASCII code. The signs ␣, ,, and / are ignored and are not output.

8-6-2. OALD73C4 (A) (B) command

A functional enhancement to the OA command, the OALD73C4 (A) (B) command causes the TR4172 to output any data displayed on its screen without having to activate functions. A sample program demonstrating how to use the OALD73C4 (A) (B) command to read VBW data is shown below.

HP Series 200 computer

```
10: DIM A$ [10]
20: OUTPUT 701 ; "OALD73C40800A0DD"
30: ENTER 701 ; A$
40: DISP A$
50: END
```

TR4511 option controller

```
10: DIM A$ (10)
20: OUTPUT 1 ; "OALD73C40800A0DD"
30: ENTER 1 ; A$
40: DISP A$
50: END
```

Line number		Explanation
HP Series 200	TR4511	
10	10	Allocates 10 bytes of character string variable A$.
20	20	Directs the TR4172 to output 0008 bytes of data in the OA output format, starting at display address DDA0, as a functional enhancement to the OA command. (See Figures 8-6 and 8-7.)
30	30	Designates the TR4172 as talker to receive data from. The TR4172 outputs the specified data (VBW).
40	40	Displays the input data (example: 100E + 3 100 kHz).
50	50	Program end

Because the execution of the OALD73C4 (A) (B) command yields data in numeric form having the unit specified by the exponential part of the data, as with the OA command, it may also be reprogrammed to read as follows:

HP Series 200 computer

```
10: OUTPUT 701 ; "OALD73C40800A0DD"
20: ENTER 701 ; A
30: DISP A
40: END
```

TR4511 option controller

```
10: OUTPUT 1 : "OALD73C40800A0DD"
20: ENTER 1 : A
30: DISP A
40: END
```

Line number		Explanation
HP Series 200	TR4511	
10	10	Directs the TR4172 to output 0008 bytes of data, starting at display address DDA0 in the OA format, as a functional enhancement to the OA command. (See Figures 8-6 and 8-7.)
20	20	Designates the TR4172 as talker to receive data from. The TR4172 outputs the specified data (VBW).
30	30	Displays the input data (example: 100000 → 100 kHz).
40	40	Program end

Usage of the OALD73C4 (A) (B) command and its output data format

While the data that can be output with the OA command is limited to active data displayed on the TR4172 screen, the OALD73C4 (A) (B) command allows any data displayed on the TR4172 screen to be output. First, check from Figures 8-6 and 8-7 the stating address and the byte length of the output data displayed on the TR4172 screen. In the example given above, you see that the starting address of the VBW is DDA0 in hexadecimal. Code this address in (B), low order first, high order next, as A0DD. Next, you see that the byte length is 8 bytes in hexadecimal, including spaces. Code this byte length in (A), low order first, high order next, as 0800. Thus, any data displayed on the TR4172 screen can be output by checking its starting address and byte length from Figures 8.6 and 8.7 and coding them in (A) and (B), respectively. As mentioned in the Note in the preceding section, the starting address must be a numeric data address. Although the output data format of the OALD73C4 (A)(B) command is

totally idetical to that of the OA command, its maximum output byte length is limited to (A) + 2 bytes, excluding block delimiters. The array declaration must be greater than or equal to the byte length (A) + 2 bytes if data is to be read as a character string variable by using a GPIB controller or similar device. The center frequency, stop frequency, marker level counter frequency, and other data depend on settings and resolutions for their data starting address and byte length.

When reading such data with the OALD73C4 (A) (B) command, code the starting address and the byte length in the following ways:

	Starting address	Byte length
Marker (counter) frequency	DC55	26
Marker (counter) level	DC97	14

The marker (counter) frequency and marker (counter) level data can be easily read by using the MF and ML commands, respectively, as described later. The center frequency, stop frequency, etc. can be easily read by setting the relevant functions active and using the OA command.

NOTE

Because the LD73C4 (A) (B) command is recognized as a command sequence having a block length of 14 bytes, only valid data should be included in it.

```
OUTPUT 701; "OA"
OUTPUT 701; "LD73C4 (A) (B)"
```

While 'OA' and "LD73C4 (A) (B)" can be separated by a block delimiter as above, "LD73C4 (A) (B)" itself cannot be separated by a block delimiter as shown below.

```
OUTPUT 701; "LD73C4"
OUTPUT 701; "(A) (B)"
```

While those of you having experience with the TR4171, TR4172, TR4170, etc. may have used the command "OALD73C5 ____" this command is not supported by the TR4172. Be sure to change it to the "OALD73C4 ____" command.
In transmitting the LD73C4 (A) (B) to the TR4172, use either CR and LF, plus a single-line signal EOI synchronized with the LF byte, or CR alone as a block delimiter.

8-6-3. MF (Marker Frequency Output) command

The MF command causes the TR4172 to output marker frequency data when it is designated as talker. A sample program demonstrating how to use the MF command to read a marker frequency is shown below.

HP Series 200 computer

```
10: DIM A$ [26]
20: OUTPUT 701 ; "MKMF"
30: ENTER 701 ; A$
40: DISP A$
50: END
```

TR4511 option controller

```
10: DIM A$ (26)
20: OUTPUT 1 : "MKMF"
30: ENTER 1 : A$
40: DISP A$
50: END
```

Line number		Explanation
HP Series 200	TR4511	
10	10	Allocates 26 bytes of character string variable A$.
20	20	Turns on the TR4172 marker for output.
30	30	Designates the TR4172 as talker to receive data from.
40	40	Displays the input data (example:␣ MKR␣␣␣␣437.2895916 MHz).
50	50	Program end

Because the execution of the MF command yields character string data, a character string variable must be used if data is to be read by using a GPIB controller or similar device.

MF command output data formats

Marker mode

```
␣MKR␣DD␣X Y DDDDDDDD.DDD XXX␣CRLF
                                (EOI)
```

- (EOI): Block delimiter
- XXX: Unit (MHz, kHz, or ␣ Hz)
- DDDDDDDD.DDD: Data part (Decimal point + Up to 11 digits)
- Y: Sign ("␣": +, "-": -)
- X: Mode (*1)
- DD: Marker number (*2)
- ␣MKR: Marker mode

Counter mode

```
CNTR␣DD␣X Y␣DDDDDDDD.DDD␣XXXCRLF
                              (EOI)
```

- (EOI): Block delimiter
- XXX: Unit (MHz, kHz, or ␣ Hz)
- DDDDDDDD.DDD: Data part (Decimal point + Up to 11 digits)
- Y: Sign ("␣": +, "-": -)
- X: Mode (*1)
- DD: Marker number (*2)
- CNTR: Frequency counter and TG counter mode

*1 Mode

d: Delta mode

z: Zoom mode

␣: Other marker mode

*2 Marker number

Multimarker mode: ␣1 to 10

Single-marker mode: ␣␣

Because the output data in the data formats in the marker and counter modes shown above is fixed at 26 bytes, the array declaration of the character string variable must be 26 bytes at least. The position of the decimal point in the data part and its data length correspond to the TR4172 screen displays. If the data part is 10 digits or shorter, the data for (11 - number of significant digits) is shifted to the beginning (before MKR or CNTR) for output. In the MF mode, the TR4172 outputs CR and LF as a block delimiter, plus a single-line signal EOI synchronized with the LF byte.
If frequency data output is specified with the MF command in a mode other than marker or counter, only space codes and block delimiters are output. If frequency counting is in progress, MRK and CNTR headers, space codes, and block delimiters are output; data is simply output as space codes.
The following TR4172-specific characters that are not in the ASCII codes are converted into the following ASCII codes for output:

Ω→␣, Δ→d, "→", o→*, μ→u

With the MF command, data cannot be output in modes other than delta, zoom, and multimarker. Detailed instructions on how to read frequencies in the counter mode and read data in various marker modes can be found in "Sample programming."

8-6-4. MFLD73C4 (A) (B) command

A functional enhancement to the MF command, the "MFLD73C4 (A) (B)" command causes the TR4172 to output any characters displayed on its screen. A sample program demonstrating how to use the "MFLD73C4 (A) (B)" command to read marker level data is shown below.

HP Series 200 computer

```
10: DIM A$ [14]
20: OUTPUT 701 ; "MFLD73C40E0099DC"
30: ENTER 701 ; A$
40: DISP A$
50: END
```

TR4511 option controller

```
10: DIM A$ (14)
20: OUTPUT 1 : "MFLD73C40E0099DC"
30: ENTER 1 : A$
40: DISP A$
50: END
```

Line number		Explanation
HP Series 200	TR4511	
10	10	Allocates 14 bytes of character string variable A$.
20	20	Directs the TR4172 to output 000E bytes of data, starting at display address DC99, as a functional enhancement to the MF command (marker level). (See Figures 8-6 and 8-7.)
30	30	Designates the TR4172 as talker to receive data from. The TR4172 outputs the specified data (marker level).
40	40	Displays the input data (example: -19.7 dBm).
50	50	Program end

Because the execution of the "MFLD73C4 (A) (B)" command character string data as with the MF command, a character string variable must be used if data is to be read by using a GPIB controller or similar device.

Usage of the "MFLD73C4 (A) (B)" command and its output data format

While data that can be output with the MF command is limited to marker frequencies, the "MFLD73C4 (A) (B)" command allows any characters displayed on the TR4172 screen to be output.
First, check from Figures 8-6 and 8-7 the starting address and the byte length of the output data displayed on the TR4172 screen. In the example given above, the starting address of the marker level is DC99 in hexadecimal. Code this address in (B), low order first, high order next, as 99DC. Next, the byte length is 0E bytes in hexadecimal, including spaces. Code this byte length in (A), low order first, high order next, as 0E00. Thus, any data displayed on the TR4172 screen can be output by checking its starting address and byte length from Figures 8-6 and 8-7 and coding them in (A) and (B), respectively.
The following TR4172-specific characters that are not in the ASCII codes are converted into the following ASCII codes for output:

$\Omega \rightarrow$ ␣ , $\Delta \rightarrow$ d , ″ → " , o → *, $\mu \rightarrow$ u

Because space codes are output as they are, the array declaration must be greater than or equal to the byte length specified by (A) if data is to be read by using a GPIB controller or similar device.

NOTE

Because the "LD73C4 (A) (B)" command is recognized as a command sequence having a block length of 14 bytes, only valid data should be included in it.

```
OUTPUT 701; "MF"
OUTPUT 701; "LD73C4 (A) (B)"
```

While "MF" and "LD73C4 (A) (B)" can be separated by a block delimiter as above, "LD73C4 (A) (B)" itself cannot be separated by a block delimiter as shown below.

```
OUTPUT 701; "LD73C4"
OUTPUT 701; "(A) (B)"
```

While those of you having experience with the TR4171, TR4172, TR4170, etc. may have used the command "MFLD73C5 ____", this command is not supported by the TR4172. Be sure to change it to the "MFLD73C4 ____" command.
In transmitting the "LD73C4 (A) (B)" to the TR4172, use either CR and LF, plus a single-line signal EOI synchronized with the LF byte, or CR alone as a block delimiter.

8-6-5. ML (Marker Level Output) command

The ML command causes the TR4172 to output marker level data when it is designated as talker. A sample program demonstrating how to use the ML command to read a marker level is shown below.

HP Series 200 computer

```
10: OUTPUT 701 ; "ML"
20: ENTER 701 ; A
30: DISP A
40: END
```

TR4511 option controller

```
10: OUTPUT 1 : "ML"
20: ENTER 1 : A
30: DISP A
40: END
```

Line number		Explanation
HP Series 200	TR4511	
10	10	Directs the TR4172 to output marker level data.
20	20	Designates the TR4172 as talker to receive data from.
30	30	Displays the input data (example: -19.7 ← -19.7 dBm).
40	40	Program end

Execution of the ML command yields numeric data without having to use a character string variable when data is read by using a GPIB controller or similar device.

ML command output data format

Data is output in the same format as it would be output by the OA command. The maximum output byte length is limited to 14 bytes, excluding block delimiters.

8-6-6. "MLLD73C4 (A) (B)" command

A functional enhancement to the ML command, the "MLLD73C4 (A) (B)" command causes the TR4172 to output any data displayed on its screen in an equivalent of the ML output format. A sample program demonstrating how to use the "MLLD73C4 (A) (B)" command to read sweep time data is shown below.

HP Series 200 computer

```
10: OUTPUT 701 ; "MLLD73C40700F3DD"
20: ENTER 701 ; A
30: DISP A
40: END
```

TR4511 option controller

```
10: OUTPUT 1 : "MLLD73C40700F3DD"
20: ENTER 1 : A
30: DISP A
40: END
```

Line number		Explanation
HP Series 200	TR4511	
10	10	Directs the TR4172 to output 0007 bytes of data, starting at display address DDF3, as a functional enhancement to the ML command (sweep time). (See Figures 8-6 and 8-7.)
20	20	Designates the TR4172 as talker to receive data from. The TR4172 outputs the specified data (sweep time).
30	30	Displays the input data (example: 0.190 ← 190 ms).
40	40	Program end

Input data may also be read as a character string variable as with the OA command as explained below.

HP Series 200 computer

```
10: DIM A$ [9]
20: OUTPUT 701 ; "MLLD73C40700F3DD"
30: ENTER 701 ; A$
40: DISP A$
50: END
```

TR4511 option controller

```
10: DIM A$ (9)
20: OUTPUT 1 : "MLLD73C40700F3DD"
30: ENTER 1 : A$
40: DISP A$
50: END
```

Line number		Explanation
HP Series 200	TR4511	
10	10	Allocates 9 bytes of character string variable A$. 9 bytes are allocated because the output length is the specified number of bytes + 2 as described in 8-6-2.
20	20	7. Directs the TR4172 to output 0007 bytes of data, starting at display address DDF3, as a functional enhancement to the ML command (sweep time). (See Figures 8-6 and 8-7.)
30	30	Designates the TR4172 as talker to receive data from. The TR4172 outputs the specified data (sweep time).
40	40	Displays the input data (example: 190E-3 → 190 ms).
50	50	Program end

Usage of the "MLLD73C4 (A) (B)" command and its output data format

While data that can be output with the ML command is limited to marker levels, the "MLLD73C4 (A) (B)" command allows any data displayed on the TR4172 screen to be output in an equivalent of the ML output format.

First, check from Figures 8-6 and 8-7 the starting address and the byte length of the output data displayed on the TR4172 screen. In the example given above, the starting address of the sweep time is DDF3 in hexadecimal. Code this address in (B), low order first, high order next, as F3DD. Next, the byte length is 7 bytes in hexadecimal, including spaces. Code this byte length in (A), low order first, high order next, as 0700. Thus, any data displayed on the TR4172 screen can be output by checking its starting address and byte length from Figures 8-6 and 8-7 and coding them in (A) and (B), respectively.

Although the output data format of the "MLLD73C4 (A) (B)" command is totally identical to that of the OA command, its maximum output byte length is limited to (A) + 2 bytes, excluding block delimiters.

In practice, because the "MLLD73C4 (A) (B)" command is internally decoded and executed as a procedure totally identical to the "OALD73C4 (A) (B)" command described earlier, either command may be used at your discretion.

NOTE

Because the "LD73C4 (A) (B)" command is recognized as a command sequence having a block length of 14 bytes, only valid data should be included in it.

```
OUTPUT 701; "ML"
OUTPUT 701; LD73C4 (A) (B)"
```

While "ML" and "LD73C4 (A) (B)" can be separated by a block delimiter as above, "LD73C4 (A) (B)" itself cannot be separated by a block delimiter as shown below.

```
OUTPUT 701; "LD73C4"
OUTPUT 701; "(A) (B)"
```

While those of you having experience with the TR4171, TR4172, TR4170, etc. may have used the command "MLLD73C5 ____", this command is not supported by the TR4172. Be sure to change it to the "MLLD73C4____" command.

In transmitting the "LD73C4 (A) (B)" to the TR4172, use either CR and LF, plus a single-line signal EOI synchronized with the LF byte, or CR alone as a block delimiter.

8-6-7. TO (Trace Data Decimal Output) command

The TO command causes the TR4172 to output, in decimal, waveform trace memory (A) and (B) data displayed on its screen (data 0 to 1,023 without having a unit in the vertical axis direction) when it is designated as talker. For the trace memory configuration, see Section 8-6-8, "RD command". A sample program demonstrating how to use the TO command is shown below.

HP Series 200 computer

```
10: OUTPUT 701 ; "RDC0180040"
20: OUTPUT 701 ; "TO"
30: ENTER 701 ; A
40: ENTER 701 ; B
50: DISP A
60: DISP B
70: END
```

TR4511 option controller

```
10: OUTPUT 1 : "RDC0180040"
20: OUTPUT 1 : "TO"
30: ENTER 1 : A
40: ENTER 1 : B
50: DISP A
60: DISP B
70: END
```

Line number		Explanation
HP Series 200	TR4511	
10	10	Directs the TR4172 to access waveform trace memory data in sequence, starting at address C018.
20	20	Directs the TR4172 to output data in decimal, starting at the address specified above.
30	30	Designates the TR4172 as talker to receive data from. The TR4172 converts data from addresses C018 and C019 into decimal for output.
40	40	Designates the TR4172 as talker to receive data from. The TR4172 converts data from addresses C01A and C01B into decimal for output.
50	50	Displays the input data A.
60	60	Displays the input data B.
70	70	Program end

Execution of the TO command thus outputs trace data (0 to 1,023, without a vertical axis unit) point after point.

NOTE

Although waveform trace memory on the TR4172 screen is organized into 12 bits per point, only the lower 10 bits are valid as data. If waveform data appears to overflow the screen due to an incorrect reference level setting, data in excess of 1,023 may be read when the TO command is executed. In this case, correct the reference level setting and retry.

Usage of the TO command and its output data format

Code the starting address of trace memory from which data is to be output in (A) in TO (A) 0040 in hexadecimal, high order first, low order next. See in Section 8-6-8. for an explanation of trace memory addresses.
Because 0040 is a constant, it must be precisely coded as 0040.

Transmit this RD (A) 0040 command, separated by block delimiters into blocks of 10 bytes each, before transmitting the TO command.
When the TR4172 is designated as talker after the RD (A) 0040 command is transmitted to it, it outputs 12-bit binary data in decimal, starting at the address (A).
Output data is output in four digits, beginning with the most significant digit, as DDDDCRLF (EOI). If the data is short of four digits, the vacant digits are filled with 0s.
There is no need to specify the output byte length. If the TR4172 is designated as talker, the output data address is automatically incremented by 2 bytes at a time, thereby allowing the data from the next point in trace memory to be output.
The TO command may also be used to output data from a source other than trace memory in decimal. If any address is specified in (A), the data at that address is automatically converted into decimal for output. Though the output format is the same, the most significant digit is always 0 because 8-bit binary data is converted into decimal. Likewise, address incrementation is automatic if the TR4172 is designated as talker, in which case the output data address is incremented by 1 byte at a time.

NOTE

When using the TO command to specify decimal output by the TR4172, separate "RD (A) 0040" and TO with a block delimiter as shown below.

```
OUTPUT 701; "RD (A) 0040"
OUTPUT 701; "TO"
```

Because the "RD (A) 0040" command is recognized as a command sequence having a block length of 10 bytes, only valid data should be included in it.
"RD (A) 0040" itself cannot be separated by a block delimiter as shown below.

```
OUTPUT 701; "RD (A)"
OUTPUT 701; "0040"
```

In transmitting the "RD (A) 0040" command to the TR4172, use either CR and LF, plus a single-line signal EOI synchronized with the LF byte, or CR alone as a block delimiter.

8-6-8. RD (Read Memory) command

The RD command causes the TR4172 to output, in hexadecimal, any memory data displayed within itself when it is designated as talker. A sample program demonstrating how to use the RD command to read waveform trace memory data is shown below.

HP Series 200 computer

```
10: DIM A$ [8]
20: OUTPUT 701 ; "RDC01800004"
30: ENTER 701 ; A$
40: DISP A$
50: END
```

TR4511 option controller

```
10: DIM A$ (8)
20: OUTPUT 1 : "RDC01800004""
30: ENTER 1 : A$
40: DISP A$
50: END
```

Line number		Explanation
HP Series 200	TR4511	
10	10	Allocates 8 bytes of character string variable A$.
20	20	Directs the TR4172 to output 4 bytes of trace memory A data (4 bytes within the TR4172 = two trace points) in hexadecimal, starting at address C018.
30	30	Designates the TR4172 as talker to receive data from.
40	40	Displays the input data. Example: 3AF139F1 Data at address C019 Data at address C018
50	50	Program end

Waveform trace memory on the TR4172 screen is organized into 12 bits per point, only the lower 10 bits are valid as data. The lower 8 bits of data are stored in the lower even-numbered addresses in memory, with the upper 4 bits of data in the upper odd-numbered addresses.

Trace memory A and trace memory B are independently assigned memory addresses for the 1,001 points on the horizontal axis as explained below.

(1) Tracing one screen in trace memory A and B each

Trace A	Address: C018, C019, ..., C7E8, C7E9 Leftmost point 1 in the screen Rightmost point 1,001 in the screen	1,001 points
Trace B	Address: C818, C819, ..., CFE8, CFE9 Leftmost point 1 in the screen Rightmost point 1,001 in the screen	1,001 points

(2) Tracing two screens in trace memory A and B each

Trace A	C018, C019, C01C, C01D, ..., C7E8, C7E9	501 points
Trace A'	C01A, C01B, C01E, C01F, ..., C7E6, C7E7	500 points
Trace B	C818, C819, C81C, C81D, ..., C8E8, C8E9	501 points
Trace B'	C81A, C81B, C81E, C81F, ..., C8E6, C8E7	500 points

To read trace memory B data, for example, replace C018 on line 10 in the sample program above with C818.

For two-screen display (A and A') in trace memory A, trace memory A data is input to numeric variable A on line 30 in the sample program and trace memory B data is input to numeric variable B on line 40. Subsequently, trace memory A and A' data is alternately input point by point likewise.

Usage of the RD command and its output data format

Code the starting address of trace memory from which data is to be output in (A) in "RD (A) (B)" and the output byte length (byte length within the TR4172, not the actual output byte length) in (B), both in hexadecimal, high order first, low order next.
Because the "RD (A) (B)" command is recognized as a command sequence having a block length of 10 bytes, only valid data should be included in it.
"RD (A) (B)" itself cannot be separated by a block delimiter as shown below.

```
OUTPUT 701; "RD"
OUTPUT 701; "(A) (B)"
```

In transmitting the "RD (A) (B)" command to the TR4172, use either CR and LF, plus a single-line signal EOI synchronized with the LF byte, or CR alone as a block delimiter.
Output data is output as $D_1D_2D_3D_4D_5D_6$.... CRLF (EOI). In this format, D_1 denotes the upper digit of the data (hexadecimal) stored at the starting address converted into ASCII code in its hexadecimal format. D_2 denotes the lower digit of the same data converted into ASCII code. D_3 denotes the upper digit of the data (hexadecimal) stored at the next address converted into ASCII code in its hexadecimal format, and so on.
Because the actual output byte length is two times the byte length specified by (B) due to hexadecimal to ASCII conversion excluding block delimiters, the array declaration must be greater than or equal to the byte length (B) multiplied by 2 if data is to be read as a character string variable by using a GPIB controller or similar device.
When trace memory data is output with the RD command, the data corresponding to the upper digit of each odd-numbered address in trace memory is always F, though it should be ignored because it is invalid data. During execution of trace arithmetic functions (such as A - B $\rightarrow$ A, NORMALIZE), it may happen that the data corresponding to the upper digit of an odd-numbered address in trace memory exceeds 3. This is because sign bits are included in the positions upper than the lower 10 bits. These bits (bits 11 and 12) should be

ignored. As previously mentioned in connection with the TO command, if waveform data exceeds 03FF (1,023 in decimal), it means an incorrect reference level setting. In this case, correct the reference level setting and retry.

8-6-9. Binary Data Output (Functional enhancement to the RD command)

As a functional enhancement to the RD command, trace memory data can be output in binary, in which case each point of trace data is output in 2 bytes, high order first, low order next. A sample program is shown below.

HP Series 200 computer

```
 10: DIM A (2001)
 20: DIM Dat (1000)
 30: OUTPUT 701 ; "RDC01803E9"
 40: OUTPUT 701 ; "LDBEB501"
 50: ENTER 701 USING "%, B" ; A(*)
 60: J = 0
 70: FOR I = 0 TO 2001 STEP 2
 80: Dat (J) = A (I) * 256 + A (I+1)
 90: J = J+1
100: NEXT I
110: END
```

TR4511 option controller

```
 10: DIM A (2001)
 20: DIM Dat (1000)
 30: OUTPUT 1 ; "RDC01803E9"
 40: OUTPUT 1 ; "LDBEB501"
 50: ENTER 1 USING "%, B" ; A(*)
 60: J = 0
 70: FOR I = 0 TO 2001 STEP 2
 80: Dat (J) = A (I) * 256 + A (I+1)
 90: J = J+1
100: NEXT I
110: END
```

NOTE

Execution of the RD command clears the current active function of the TR4172.

Line number		Explanation
HP Series 200	TR4511	
10	10	Allocates 2,002 bytes of numeric variable A.
20	20	Allocates 1,001 bytes of numeric variable Dat.
30	30	Directs the TR4172 to output 1,001 points of trace memory A data, starting at address C018.
40	40	Directs the TR4172 to output trace memory data in binary, starting at the address specified above.
50	50	Designates the TR4172 as talker to receive data from.
60	60	Resets the index J.
70	70	FOR loop in which the value of I is incremented from 0 to 2,000 by 2 at a time.
80	80	Converts the output data (2 bytes per point) into one byte per point and store it in Dat.
90	90	Increments the index J to 1.
100	100	Runs the FOR loop of the loop counter I.
110	110	Program end

8-6-10. LD (Load Memory) command

The LD command is used to write data to any memory location in the TR4172. If this command is used, TR4172 measurement data can be read with other data output commands and subjected to arithmetic manipulations by the GPIB controller, then rewritten into the TR4172 screen for display. It also permits writing the upper and lower levels of measurement. A sample program demonstrating how to use the LD command is shown below.

HP Series 200 computer

```
10: OUTPUT 701 ; "BVSHAV"
20: OUTPUT 701 ; "LDC90023FAB31C"
30: END
```

TR4511 option controller

```
10: OUTPUT 1 ; "BVSHAV"
20: OUTPUT 1 ; "LDC90023FAB31C"
30: END
```

Line number		Explanation
HP Series 200	TR4511	
10	10	Sets TR4172 trace memory to B VIEW, A BLANK.
20	20	Writes 23, FA, B3, and 1C in hexadecimal to TR4172 internal memory, starting at address C900.
30	30	Program end

Execution of this LD command writes 23 to address C900, FA to address C901, B3 to address C902, and 1C to address C903, all in hexadecimal.

Usage of the LD command

Code the write starting address in (A) in "LD (A) (B)" in hexadecimal, high order first, low address next, and the data to write in (B) in hexadecimal in sequence.

Because the "LD (A) (B)" command is recognized as a command sequence having a block length of 10 bytes, only valid data should be included in it.

The (A)(B) command cannot be separated by a block delimiter as shown below.

```
OUTPUT 701 ; "LD"
OUTPUT 701 ; (A) (B)
```

In transmitting the "LD (A) (B)" command to the TR4172, use either CR and LF, plus a single-line signal EOI synchronized with the LF byte, or CR alone as a block delimiter.

8-6-11. TI (Trace Data Input) command

The TI command is used to write data 0 to 1,023 to waveform trace memory in the TR4172. A sample program demonstrating how to use the TI command is shown below.

HP Series 200 computer

```
10: OUTPUT 701 ; "AVRDC180040"
20: OUTPUT 701 ; "TI"
30: FOR A=1 TO 1001
40: OUTPUT 701 ; A
50: NEXT A
60: END
```

TR4511 option controller

```
10: OUTPUT 1 : "AVRDC180040"
20: OUTPUT 1 : "TI"
30: FOR A=1 TO 1001
40: OUTPUT 1 : A
50: NEXT A
60: END
```

Line number		
HP Series 200	TR4511	Explanation
10	10	Sets TR4172 trace memory to A VIEW. Directs the TR4172 to access waveform trace memory data in sequence, starting at address C018.
20	20	Directs the TR4172 to output data in decimal, starting at the address specified above.
30	30	Assigns a sequentially incremented value to variable A, starting at the initial value of 1.
40	40	Writes data A to TR4172 trace memory A.
50	50	Returns to line 30 unless the value of variable A exceeds 1,001.
60	60	Program end

Be sure to hold data to write to trace memory to 0 to 1,000 in decimal. Though data can be written up to 1,023, it would overflow the TR4172 screen if written. Note that, if writing of data above 1,204 is attempted, it may be truncated when converted internally.

Usage of the TI command

```
OUTPUT 701; "RD (A) 0040"
OUTPUT 701; "TI"
```

Code the write starting address in (A) in "RD (A) 0040" in hexadecimal, high order first, low order next. Because 0040 is a constant, it must be precisely coded as '0040'. Transmit this "RD (A) 0040" command, separated by block delimiters into blocks of 10 bytes each, before transmitting the TI command.
As the TR4172 is set in the decimal data input mode after the "RD (A) 0040" command and the TI command are transmitted to it, enter one point of decimal data next. Data can be written sequentially without having to specify the write byte length; provided, however, that the

data must be entered point by point and separated by block delimiters (CR and LF, plus a single-line signal EOI synchronized with the LF byte, or CR alone). Each time data is written to TR4172 trace memory, the write address is automatically incremented by one point of trace memory (2 bytes).

. Data cannot be entered without a decimal point. If input data contains a decimal point, the data below the decimal point is ignored. This mode is automatically canceled when the input data cannot be recognized as a decimal number.

> NOTE
>
> Execution of the TI command clears the current active function of the TR4172.

8-7. Label Entry

When a label is entered, the first optional character that follows the label entry program code LA is recognized as a terminator. Enter the character string to be displayed as a label in the label area in the top of the screen, separated by terminator characters. A sample program using an HP85 and a TR4511 option controller is shown below.

[Example 3]: Write A B C D as a label. (Use "?" as a terminator.)

HP85

```
10    OUTPUT 701 ; "LA ? ABCD?"
20    END
```

TR4511 option controller

```
10    OUTPUT 1 : "LA ? ABCD?"
20    END
```

Line number	Explanation
10	Displays the character string "ABCD" in the label area.
20	Program end

8-8. Learn Mode

The TR4172 keeps save registers 1 to 8 open to the user. Additions can be made to the TR4172's save registers in a virtual manner by using the GPIB controller memory.
First, set the TR4172 into the desired save state by using TR4172 panel keys or the GPIB controller. Next, save this status in the TR4172's save register 0, and read the status information stored in save register 0 into the GPIB controller memory.
In this way, additions can be made to the TR4172's save registers by using its save register 0 as a buffer. Next, write the TR4172 status information saved in the GPIB controller memory to the TR4172's save register 0 and execute recall 0, and the TR4172 status information saved in the GPIB controller memory can be recalled.
A sample program is shown below.

HP Series 200 computer

```
 10: DIM A$ [94]
 20: OUTPUT 701 ; "SHIN0"
 30: OUTPUT 701 ; "RD7400002E"
 40: ENTER 701 ; A$
   ⟆
100: OUTPUT 701 ; "LD7400" ; A$
110: OUTPUT 701 ; "SHLI0"
```

TR4511 option controller

```
 10: DIM A$ (94)
 20: OUTPUT 1 : "SHIN0"
 30: OUTPUT 1 : "RD7400002E"
 40: ENTER 1 : A$
   ⟆
100: OUTPUT 1 : "LD7400" : A$
110: OUTPUT 1 : "SHLI0"
```

Line number		
HP Series 200	TR4511	Explanation
10	10	Allocates 94 bytes of character string variable A$.
20	20	Saves the current TR4172 setting in save register 0.
30	30	Directs the TR4172 to output 2EH bytes of data from save register 0 in hexadecimal, starting at address 7400.
40	40	Designates the TR4172 as talker to receive data from.
⁞	⁞	
100	100	Writes the data stored in character string variable A$ (save register 0), starting at TR4172 address 7400.
110	110	Sets the TR4172 in recall 0.

As the starting address of save register 0, the address 7400 must be precisely coded as such. Because each TR4172 save register is made up of 2EH bytes, the array declaration in the character string variable must be greater than or equal to 2EH + 1 = 94 bytes if the register data is to be output in hexadecimal.

8-9. Block Delimiters

When the TR4172 is designated as talker to output ASCII data, The TR4172 outputs a 2-byte code of CR and LF as a block delimiter, plus a single-line signal EOI synchronized with the LF byte. When the TR4172 outputs binary data, it outputs a single-line signal EOI synchronized with the last byte of the data.

When program codes or data are input to the TR4172 from a GPIB controller or similar device, it operates with one of the following block delimiters:

(1) A 2-byte code of CR and LF, plus a single-line signal EOI synchronized with the LF byte.

(2) A 1-byte code of LF.

(3) A single-line signal EOI synchronized with the last byte of data.

(4) A 2-byte code of CR and LF.

Note, however, that the aforementioned data I/O commands - OA, MF, ML, TO, RD, LD, and TI - operate only on specified delimiters. For how to specify these block delimiters, refer to the descriptions of the relevant commands.

8-10. Data Transfer Rates

Sample programs that measure the data transfer rates of decimal output, hexadecimal image output, and binary output are shown below, along with the measurement data. (Each of these sample programs measures the rate at which 1,001 points of data are transferred from trace memory A.) These programs are intended only for reference purposes. Because the internal system software operates on interrupt handling principles, the data transfer rates indicated below may not be established under certain setup conditions.

HP Series 200 computer

1) Decimal output

```
10: DIM D(1000)
20: J=TIMEDATE
30: OUTPUT 701 ; "RDC01807D2"
40: OUTPUT 701 ; "TO"
50: FIR I=0 TO 1000
60: ENTER 701 ; D(I)
70: NEXT I
80: PRINT TIMEDATE-J
90: END
```

2) Hexadecimal image output

```
10: DIM H$ [4003]
20: J=TIMEDATE
30: OUTPUT 701 ; "RDC01807D2"
40: ENTER 701 ; H$
50: PRINT TIMEDATE-J
60: END
```

3) Binary output

```
10: DIM B(2001)
20: J=TIMEDATE
30: OUTPUT 701 ; "RDC01803E9"
40: OUTPUT 701 ; "LDBEB501"
50: ENTER 701 USING "%,B" ; B(*)
60: PRINT TIMEDATE-J
70: END
```

Data transfer ratesh

Output mode \ Trigger mode	FREE RUN	SINGLE
Decimal output	2.58	2.50
Hexadecimal image output	0.27	0.26
Binary output	1.80	1.79

Unit: s

8-11. Service Requests

Using the GPIB service request facility enables the GPIB controller to detect the following conditions of the TR4172:

(1) The TR4172 has completed a screen trace up to the rightmost end of the screen.

(2) The TR4172 has completed a preset number of times of averaging.

The serial poll status byte indicates these conditions. Table 8-3 analyzes the configuration of the status byte.

Table 8-3 Status byte format

BIT #	7	6	5	4	3	2	1	0
Decimal value	128	64	32	16	8	4	2	1
Function		SERVICE REQUEST (SRQ)			AVERAGE END	TRACE END		

Bit 2: Set to 1 when the TR4172 has completed a screen trace up to the rightmost end of the screen. This bit is 0 while a trace is in progress.

Bit 3: Set to 1 when the TR4172 has completed a preset number of times of averaging. This bit is 0 until the preset number of times of averaging is reached. (With averaging on, bit 2 is set from 0 to 1 at the same time that bit 3 is set to 1.)

The service request can be turned on and off by using the GPIB program codes SQ and SR.

SQ: Enables service request transmission.

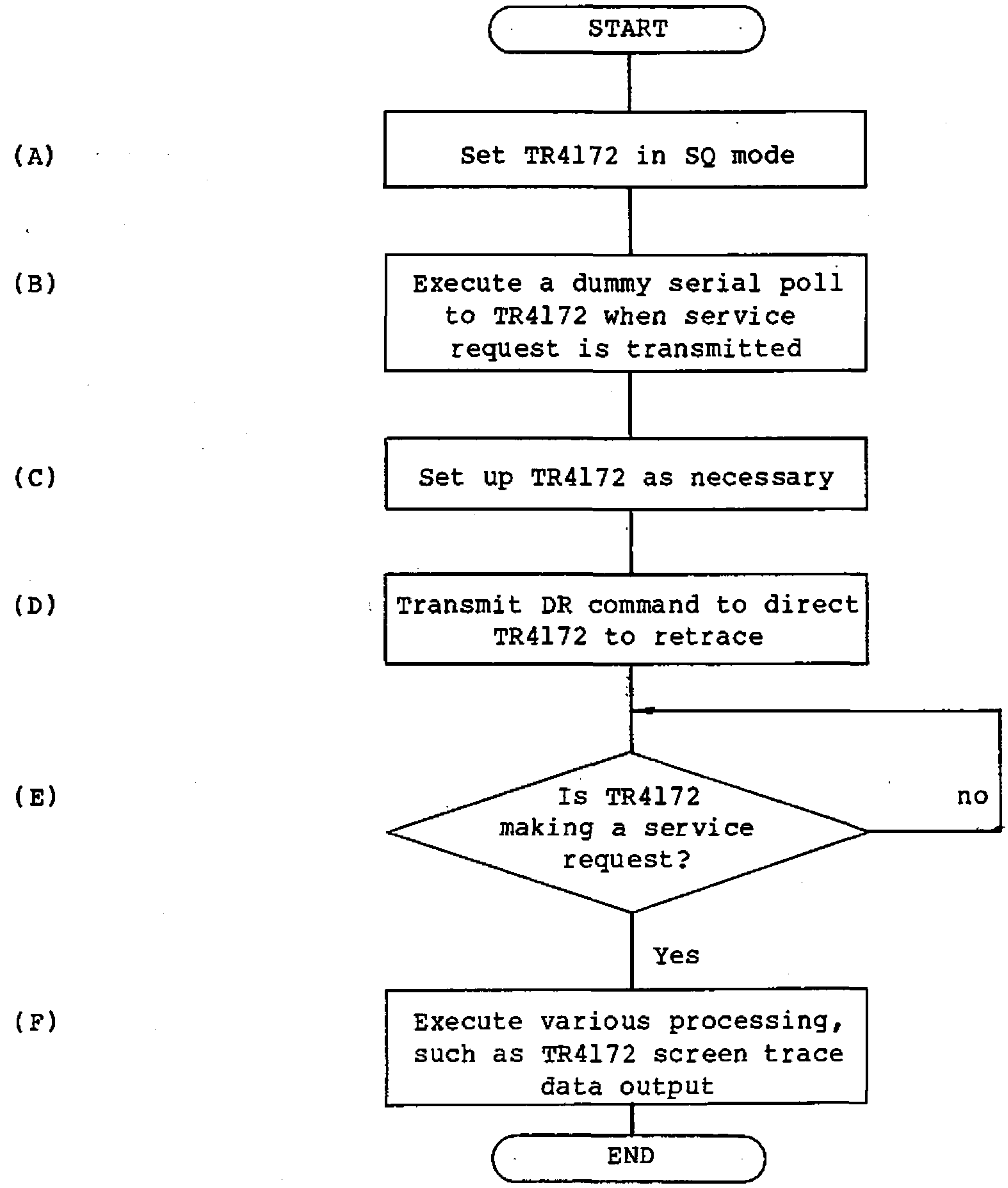
SR: Disables service request transmission.

If a service request condition arises after the SQ mode has been set, the TR4172 halts its screen trace and issues a service request to the GPIB controller. The GPIB controller can direct the TR4172 to output data for arithmetic processing. To resume the screen trace to obtain measurement data after various processing has been completed and necessary changes have been made to the TR4172 status, transmit the DR (status byte reset & trace start) command. This command restarts the TR4172 screen trace. Since the TR4172 is still in the SQ mode, it will halt its screen trace again if another service request condition occurs.

To exit from the SQ mode and return to the SR mode (disables service request transmission) and thus restore the TR4172 trace status to normal, transmit the SR command, then the DR command.

If the SR mode is changed to the SQ mode after various changes have been made to the TR4172 panel status, invalid TR4172 screen trace data could result. To prevent this, execute a dummy serial poll to the TR4172 immediately after the SQ mode is set, then transmit the DR command to retrace the display data.

To obtain screen trace measurement data after various changes have been made to the TR4172 panel status in the SQ mode, also transmit the DR command to retrace the display data. These procedures are flowcharted below.



Note: Because a hardware sweep and a software trace in the TR4172 occur totally independently, it may happen that trace memory does not provide a correct trace of the setup status throughout a screen under certain setup conditions in (F). To prevent this, execute processes (D) and (E) in succession ((D) → (E) → (D) → (E)).
For averaging, turn on averaging (C), in which case (D) need not be executed. If (D) is executed, SRQ would not be output.

A sample program demonstrating how to use a service request to determine the peak level of an input signal around 1 MHz is shown below.

HP Series 200 computer

```
 10: OUTPUT 701 ; "SQ"
 20: ON INTR 7 GOTO 50
 30: ENABLE INTR 7 ; 2
 40: GOTO 30
 50: S=SPOLL(701)
 60: OUTPUT 701 ; "CF 1MZ SP 50KZ RE 10DM"
 70: GOSUB 120
 80: OUTPUT 701 ; "MK PS ML"
 90: ENTER 701 ; A
100: DISP A
110: STOP
120: OUTPUT 701 ; "DR"
130: ON INTR 7 GOTO 160
140: ENABLE INTR 7 ; 2
150: GOTO 140
160: S=SPOLL(701)
170: IF S=68 THEN 190
180: GOTO 120
190: RETURN
200: END
```

TR4511 option controller

```
 10: OUTPUT 1 : "SQ"
 20: ON SRQ GOTO 50
 30: ENABLE INTR
 40: GOTO 30
 50: S=SPOLL(1)
 60: OUTPUT 1 : "CF 1MZ SP 50KZ RE 10DM"
 70: GOSUB 120
 80: OUTPUT 1 : "MK PS ML"
 90: ENTER 1 : A
100: DISP A
110: END
120: OUTPUT 1 : "DR"
130: ON SRQ GOTO 160
140: ENABLE INTR
150: GOTO 140
```

```
160: S=SPOLL(1)
170: IF S=68 THEN 190
180: GOTO 120
190: RETURN
```

Line number		
HP Series 200	TR4511	Explanation
10	10	Sets the TR4172 in the SRQ mode.
20	20	Directs the controller to jump to line 50 when a GPIB SRQ interrupt occurs.
30	30	Sets the controller in the mode enabling the GPIB SRQ interrupts.
40	40	Directs the controller to loop without doing anything until a GPIB SRQ interrupt occurs.
50	50	Directs the controller to execute a serial poll to the TR4172 when a GPIB SRQ interrupt occurs. (Lines 20 to 60 contain procedures for a single run of dummy processing of the service request immediately following the setting of the TR4172 in the SQ mode.)
60	60	Sets the TR4172 at a center frequency of 1 MHz, a frequency span of 50 kHz, and a reference level of -10 dBm.
70	70	Calls a subroutine from line 120.
80	80	Turns on the TR4172 marker to effect a peak search for peak level output.
90	90	Designates the TR4172 as talker to receive data from.
100	100	Displays the input data.
110	110	Program halt
120	120	Resets the TR4172 status byte to resume the trace.
130	130	Directs the controller to jump to line 160 when a GPIB SRQ interrupt occurs.
140	140	Sets the controller in the mode enabling the GPIB SRQ interrupts.
150	150	Directs the controller to loop without doing anything until a GPIB SRQ interrupt occurs.

Line number		Explanation
HP Series 200	TR4511	
160	160	Directs the controller to execute a serial poll to the TR4172 and receive the status byte when a GPIB SRQ interrupt occurs.
170	170	Directs the controller to jump to line 190 if the TR4172 status is trace end.
180	180	If the TR4172 status is not trace end, directs the TR4172 to retrace, with the controller looping until the next GPIB SRQ interrupt occurs.
190	190	Returns from the subroutine (to line 80).
200	200	Program end

Next, a sample program demonstrating how to use a service request in the TR4172 SINGLE TRIGGER mode is shown below. In the SINGLE TRIGGER mode, the DR command must be preceded with the SHSW (sweep reset) command.

HP Series 200 computer

```
 10: OUTPUT 701 ; "IP SW 2SC"
 20: OUTPUT 701 ; "SQ"
 30: ON INTR 7 GOTO 60
 40: ENABLE INTR 7 ; 2
 50: GOTO 40
 60: S=SPOLL(701)
 70: OUTPUT 701 ; = "SI MK"
 80: GOSUB 120
 90: OUTPUT 701 ; "ML"
100: ENTER 701 ; A
110: DISP A
120: STOP
130: OUTPUT 701 ; "SHSW"
135: OUTPUT 701 ; "DR"
140: ON INTR 7 GOTO 160
150: ENABLE INTR 7 ; 2
160: GOTO 140
```

```
  170: S=SPOLL(701)
  180: IF S=68 THEN 190
  190: GOTO 135
  200: RETURN
  210: END
```

TR4511 option controller

```
   10: OUTPUT 1 : "IP SW 2SC"
   20: OUTPUT 1 : "SQ"
   30: ON SRQ GOTO 60
   40: ENABLE INTR
   50: GOTO 40
   60: S=SPOLL(1)
   70: OUTPUT 1 : "SI MK ML"
   80: GOSUB 120
   90: OUTPUT 1 : "ML"
  100: ENTER 1 : A
  110: DISP A
  120: END
  130: OUTPUT 1 : "SHSW"
  135: OUTPUT 1 : "DR"
  140: ON SRQ GOTO 160
  150: ENABLE INTR
  160: GOTO 140
  170: S=SPOLL(1)
  180: IF S=68 THEN 190
  190: GOTO 135
  200: RETURN
```

Line number		Explanation
HP Series 200	TR4511	
10	10	Sets a 2-second sweep time after setting the TR4172 in the instrumental preset state.
20	20	Sets the TR4172 in the SQ mode.
30	30	Directs the controller to jump to line 60 when a GPIB SRQ interrupt occurs.

Line number		Explanation
HP Series 200	TR4511	
40	40	Sets the controller in the mode enabling the GPIB SRQ interrupts.
50	50	Directs the controller to loop without doing anything until a GPIB SRQ interrupt occurs.
60	60	Directs the controller to execute a serial poll to the TR4172 when a GPIB SRQ interrupt occurs. (Lines 30 to 60 contain procedures for a single run of dummy processing of the service request immediately following the setting of the TR4172 in the SRQ mode.)
70	70	Sets the TR4172 in the SINGLE TRIGGER mode and turns on the marker.
80	80	Calls a subroutine from line 120.
90	90	Directs the TR4172 to output marker level data when it is designated as talker.
100	100	Designates the TR4172 as talker to receive data from. (The TR4172 outputs the marker level.)
110	110	Displays the input data.
120	120	Program halt
130	130	Transmits the SHSW command to the TR4172 and resets the status byte.
135	135	Resumes the trace.
140	140	Directs the controller to jump to line 160 when a GPIB SRQ interrupt occurs.
150	150	ets the controller in the mode enabling the GPIB SRQ interrupts.
160	160	Directs the controller to loop without doing anything until a GPIB SRQ interrupt occurs.
170	170	Directs the controller to execute a serial poll to the TR4172 and receive the status byte when a GPIB SRQ interrupt occurs.
180	180	Directs the controller to jump to line 190 if the TR4172 status is trace end.

Line number		Explanation
HP Series 200	TR4511	
190	190	If the TR4172 status is not trace end, directs the TR4172 to retrace, with the controller looping until the next GPIB SRQ interrupt occurs.
200	200	Returns from the subroutine (to line 90).
210		Program end

NOTE

To exit from the SQ mode and return to the SR mode (disables service request transmission) and thus restore the TR4172 trace status to normal, transmit the SR command, then the DR command.
If the DR command is not transmitted, the SR mode is set but the trace will remain halted without returning to normal status.
Trace memory may not provide a correct trace of the TR4172 setup status immediately after its function settings (such as CENTER FREQ. and REF. LEVEL) have been altered, immediately after the SQ mode has been set, and when a service request has been received. In this case, transmit the DR command to direct TR4172 to execute a retrace, or alternatively, transmit the SQ command to override the initial service request, then complete various status changes as necessary before transmitting the DR command for a retrace.

8-12. Direct Plotting Using the GPIB Controller

Because the built-in direct plot software in the TR4172 lets the TR4172 function as a GPIB controller by itself, certain care should be exercised when another GPIB controller is used to execute direct plotting. A sample program demonstrating the use of another GPIB controller is shown below.

HP Series 200 computer

```
 10: OUTPUT 701 ; "SQ"
 20: OUTPUT 701 ; "CF50MZSP1MZ"
 30: GOSUB 130
 40: OUTPUT 701 ; "DR"
 50: GOSUB 180
 60: OUTPUT 701 ; "LD783D00"
 70: OUTPUT 701 ; "SHLA221"
 80: SEND 7 ; UNL TALK 1 LISTEN 5 DATA
 90: GOSUB 210
100: DISP "PLOT END"
110: OUTPUT 701 ; "SRDR"
120: STOP
130: ON INTR 7 GOTO 160
140: ENABLE INTR 7 ; 2
150: GOTO 140
160: S=SPOLL(701)
170: RETURN
175: OUTPUT 701 ; "DR"
180: GOSUB 130
190: IF S<>68 THEN 175
200: RETURN
205: OUTPUT 701 ; "DR"
210: GOSUB 130
220: IF BIT(S,4) THEN 240
230: GOTO 205
240: RETURN
250: END
```

TR4511 option controller

```
 10: OUTPUT 1 : "SQ"
 20: OUTPUT 1 : "CF50MZSP1MZ"
 30: GOSUB 130
 40: OUTPUT 1 : "DR"
 50: GOSUB 180
 60: OUTPUT 1 : "LD783D00"
 70: OUTPUT 1 : "SHLA221"
 80: SEND UNL TALK 1 LISTEN 5 DATA
```

```
 90: GOSUB 210
100: DISP "PLOT END"
110: OUTPUT 1 : "SRDR"
120: END
130: ON SRQ GOTO 160
140: ENABLE INTR
150: GOTO 140
160: S=SPOLL(1)
170: RETURN
175: OUTPUT 1 : "DR"
180: GOSUB 130
190: IF S<>68 THEN 180
200: RETURN
205: OUTPUT 1 : "DR"
210: GOSUB 130
220: IF BIT(S,4) THEN 240
230: GOTO 205
240: RETURN
```

If using the standard TR9831 or TR9834R, substitute "PL" for "SHLA2" on line 70. Proceed to enter values as required by the subsequent key operations.

Line number		Explanation
HP Series 200	TR4511	
10	10	Sets the TR4172 in the SQ mode.
20	20	Sets the TR4172 at a center frequency of 50 MHz and a frequency span of 1 MHz.
30	30	Calls a subroutine from line 130 (for dummy processing of the service request immediately following the setting of the TR4172 in the SQ mode.)
40	40	Resets the TR4172 status byte to resume the trace.
50	50	Calls a subroutine from line 180 (to wait for the end of the TR4172 trace).
60	60	Resets the TR4172 GPIB serial poll register.

Line number		
HP Series 200	TR4511	Explanation
70	70	SHLA2: Loads the option 07 PLOT program. 2: Selects 7470. 1: Selects ALL.
80	80	Cancels all listeners and designates the TR4172 as talker. Designates the plotter as listener. Sets ATN to HI.
90	90	Calls a subroutine from line 210.
100	100	Issues the message "PLOT END."
110	110	Sets the TR4172 in the SRQ mode, and resets its status byte to resume the trace.
120	120	Program halt
130	130	Directs the controller to jump to line 160 when a GPIB SRQ interrupt occurs.
140	140	Sets the controller in the mode enabling the GPIB SRQ interrupts.
150	150	Directs the controller to loop without doing anything until a GPIB SRQ interrupt occurs.
160	160	Directs the controller to execute a serial poll to the TR4172 when a GPIB SRQ interrupt occurs.
170	170	Returns from the subroutine.
175	175	Retrace.
180	180	Calls the subroutine from line 130.
190	190	If the TR4172 status is not trace end, directs the TR4172 to retrace, with the controller looping until the next GPIB SRQ interrupt occurs.
200	200	Returns from the subroutine.
205	205	Retrace.
210	210	Calls the subroutine from line 130.

Line number		
HP Series 200	TR4511	Explanation
220	220	Directs the controller to jump to line 240 if the TR4172 status is plot end.
230	230	If the TR4172 status is not plot end, directs the TR4172 to retrace, with the controller looping until the next GPIB SRQ interrupt occurs.
240	240	Returns from the subroutine.
250	250	Program end

Line 60 is mandatory. If line 60 is not executed, the TR4172 plot end status would not be set. Consequently, control could not return from the subroutine call on line 90.

8-13. Programming Notes

GPIB programming for the TR4172 is essentially accomplished by coding procedures in the same way as you press panel keys, though certain points require special attention.

8-13-1. Counter programming

Just like panel operations, transmitting the counter program codes CN and FC, or SHFC and SHCN once turns on the counter; transmitting these codes once again turns the counter off.
Because the counter is turned off whenever the counter program codes CN and FC, or SHFC and SHCN are transmitted while the marker is off, it is recommended that you turn on the marker after once turning it off, then turn on the counter to ensure operational accuracy.
The TR4172 service request facility does not have counter end status. When the counter is used, set a wait time according to the available counter resolution. The wait time can be generally calculated by:

$$\boxed{\text{(Wait time)} \geqq \text{(Counter gate time)} + \text{(Sweep time)} \times 2}$$

8-13-2. Phase mode programming

(1) Phase scale setting

Transmit the codes listed below to directly set numeric data for the phase scale. Only "HZ" can be used as a termination.

Phase Scale	GPIB code
80°/div	0HZ, 1HZ
40°/div	2HZ, 3HZ
20°/div	4HZ, 5HZ
8°/div	6HZ
4°/div	7HZ
2°/div	8HZ
0.8°/div	9HZ
0.4°/div	10HZ
0.2°/div	11HZ

(2) Phase offset setting

Notice that the only termination that can be used in setting numeric data is "HZ."

8-13-3. Group delay mode programming

(1) Group delay scale setting

Numeric data for the group delay scale cannot be set directly. Rather, use either the data knob or step key GPIB code. The current scale data can be read by using the OA command in conjunction.

(2) Group delay offset (fine) setting

Notice that the only termination that can be used in setting numeric data is "HZ".

8-14. GPIB Usage Notes

8-14-1. MASTER RESET key

Similar in function to the POWER switch, the MASTER RESET key is operable regardless of the GPIB interface status. Pressing the MASTER RESET key clears the TR4172 GPIB interface temporarily.

8-14-2. DEVICE CLEAR (DCL and SDC) and IP commands

Both the DEVICE CLEAR (DCL and SDC) and IP commands initialize the settings of the TR4172. The device is reset to an equivalent to the status that would be established on a power-on reset and by pressing the MASTER RESET key.

8-14-3. GROUP EXECUTE TRIGGER

Because the TR4172 GPIB interface facility does not support the group execute trigger, this message is ignored if it is received. "T" is displayed in the active area on the screen at this time.

8-14-4. INTERFACE CLEAR and ATN

If the TR4172 GPIB interface receives INTERFACE CLEAR or ATN=TRUE while it is handshaking with data as a talker or listener, it handles INTERFACE CLEAR or ATN=TRUE on a priority basis. Consequently, the data then in the middle of handshaking may be ignored.

8-14-5. TALKER

If a high (= false) on both NRFD and NDAC is detected while the TR4172 is handshaking on the GPIB interface as a talker, the handshaking procedure is forced to a termination.

8-14-6. SERVICE REQUEST

The SRQ on and off modes are not cleared by the DEVICE CLEAR and IP commands.

Table 8-4 Address code table

ASCII coded character		ADDRESS switch					5-bit decimal code
LISTEN	TALK	A5	A4	A3	A2	A1	
SP	@	0	0	0	0	0	0
!	A	0	0	0	0	1	1
"	B	0	0	0	1	0	2
#	C	0	0	0	1	1	3
$	D	0	0	1	0	0	4
%	E	0	0	1	0	1	5
&	F	0	0	1	1	0	6
'	G	0	0	1	1	1	7
(	H	0	1	0	0	0	8
)	I	0	1	0	0	1	9
*	J	0	1	0	1	0	10
+	K	0	1	0	1	1	11
,	L	0	1	1	0	0	12
-	M	0	1	1	0	1	13
.	N	0	1	1	1	0	14
/	O	0	1	1	1	1	15
0	P	1	0	0	0	0	16
1	Q	1	0	0	0	1	17
2	R	1	0	0	1	0	18
3	S	1	0	0	1	1	19
4	T	1	0	1	0	0	20
5	U	1	0	1	0	1	21
6	V	1	0	1	1	0	22
7	W	1	0	1	1	1	23
8	X	1	1	0	0	0	24
9	Y	1	1	0	0	1	25
:	Z	1	1	0	1	0	26
;	[	1	1	0	1	1	27
<	\	1	1	1	0	0	28
=	]	1	1	1	0	1	29
>	~	1	1	1	1	0	30

Table 8-5 Programming Codes

Item	Code	Description	Initially selected
DATA	0 to 9	0 to 9	
	.	.	
	MZ	MHz	
	KZ	kHz	
	HZ	Hz	
	DP	+dBm	
	DM	-dBm	
	DB	dB	
	SC	sec	
	MS	msec	
	US	µsec	
	UP	⇧	
	DN	⇩	
	CU	COARSE UP (Data knob, clockwise)	
	MU	MIDIUM UP (Data knob, clockwise)	
	FU	FINE UP (Data knob, clockwise)	
	CD	COARSE DOWN (Data knob, counterclockwise)	
	MD	MIDIUM DOWN (Data knob, counterclockwise)	
	FD	FINE DOWN (Data knob, counterclockwise)	
	BS	BACK SPACE	
Measurement mode	NO	NORMAL	o
	TG	TG ON	
	PG	PHASE	
	GD	GROUP DELAY	

Table 8-5 Programming Codes (cont'd)

Item	Code	Description	Initially selected
FUNCTION	CF	CENTER FREQ.	
	SP	FREQ. SPAN	
	RE	REF. LEVEL	
	SW	SWEEP TIME	
	AS	SWEEP TIME AUTO	o
	RB	RES. B. W.	
	BA	RES. B. W. AUTO	o
	VB	VIDEO B. W.	
	VA	VIDEO B. W. AUTO	o
	CS	FREQ. STEP SIZE	
	CA	FREQ. STEP SIZE AUTO	o
SCALE	PY	PHASE SCALE	
	GY	GROUP DELAY SCALE	
I/O	AT	INPUT ATT	
	TA	INPUT ATT AUTO	o
	TL	TG LEVEL	
	PR	INPUT-2	
	DC	INPUT-1 DC	
	AC	INPUT-1 AC	o
TRIGGER	IN	FREE RUN	o
	LI	LINE	
	EX	EXT	
	VT	VIDEO	
	SI	SINGLE	

Table 8-5 Programming Codes (cont'd)

Item	Code	Description	Initially selected
TRACE	AW	A WRITE	o
	AV	A VIEW	
	AZ	A' VIEW	
	BW	B WRITE	
	BV	B VIEW	
	BZ	B'VIEW	
	BB	B → B'	
	CH	A ⇄ B	
	AB	A-B → A ON	
	BD	B-DL → B	
SAVE & RECALL	SA	SAVE	
	RC	RECALL	
MARKER	MK	MARKER	
	MO	MARKER OFF	o
	MT	Δ	
	PS	PEAK SEARCH	
	MC	MKR → CF	
	MR	MKR → REF	
	MP	MKR/Δ→ STEP SIZE	
	SG	SIGNAL TRACK	
	ZO, OO	ZOOM	
	CN, FC	COUNTER	
Others	DL	DISPLAY LINE	
	LA	LABEL	
	PL	PLOT	
	HO	DATA HOLD	
	LC	LOCAL	
	SH	SHIFT	
	IP	INSTRUMENTAL PRESET(0 to 2 GHz)	o

Table 8-5 Programming Codes (cont'd)

Item	Code	Description	Initially selected
DATA	SQ	Service Request Enable	
IN/OUT	SR	Service Request Disable	
	DR	Status byte Reset & Trace start	
	MF	MARKER FREQ OUTPUT	
	ML	MARKER LEVEL OUTPUT	
	OA	OUTPUT ACTIVE DATA	
	LD	LOAD MEMORY	
	RD	READ MEMORY	
	TO	TRACE DATA DECIMAL OUTPUT	
	TI	TRACE DATA DECIMAL INPUT	

The functions marked by a circle (o) are automatically set when the power is turned on, when the MASTER RESET key is pressed, when the IP command is received, or when the Device Clear message is received.
To execute shift and double-shift key functions, enter SH and SHLA followed by the codes associated with the panel keys, respectively.

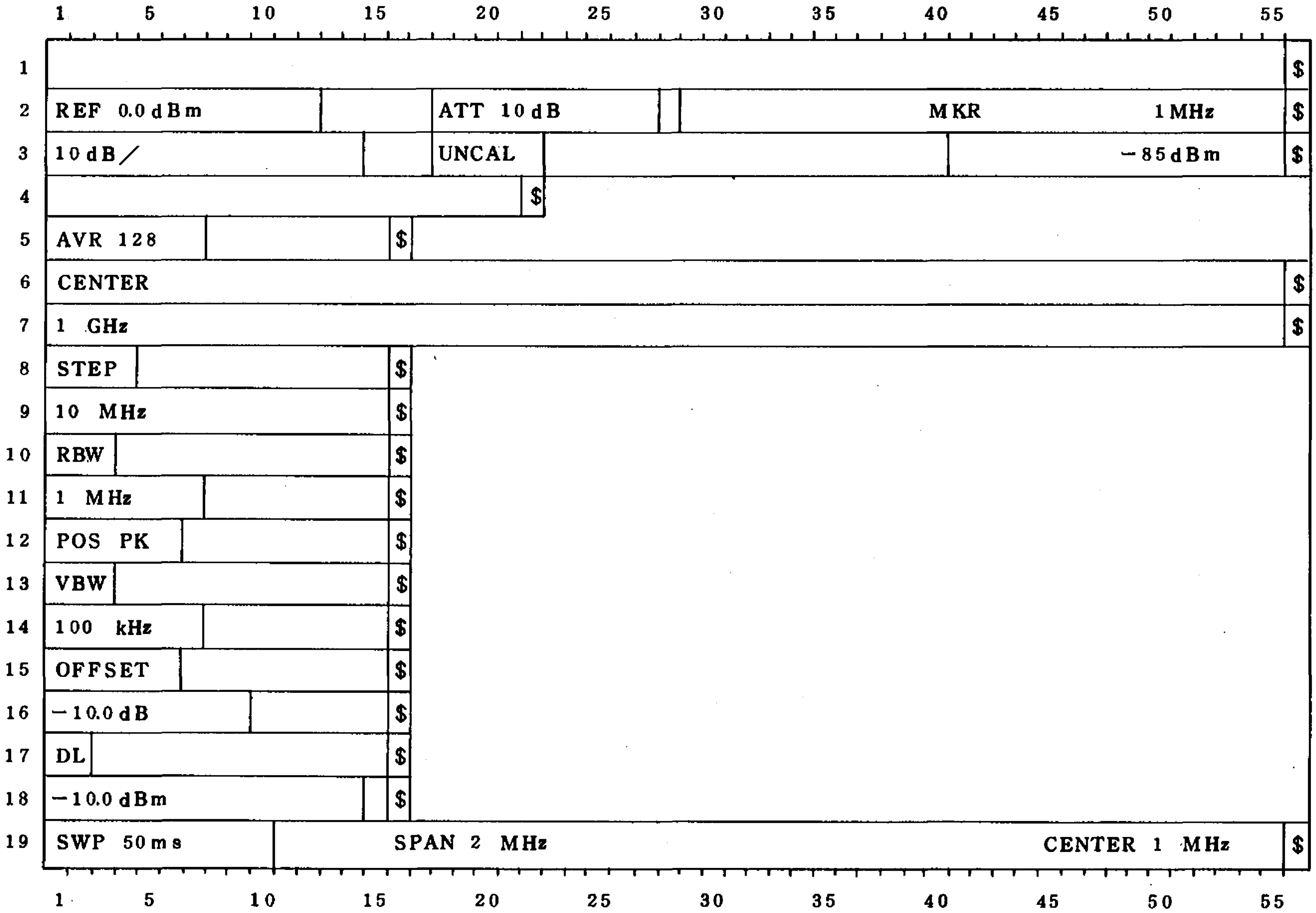


Fig. 8-6 TR4172 Character Locations

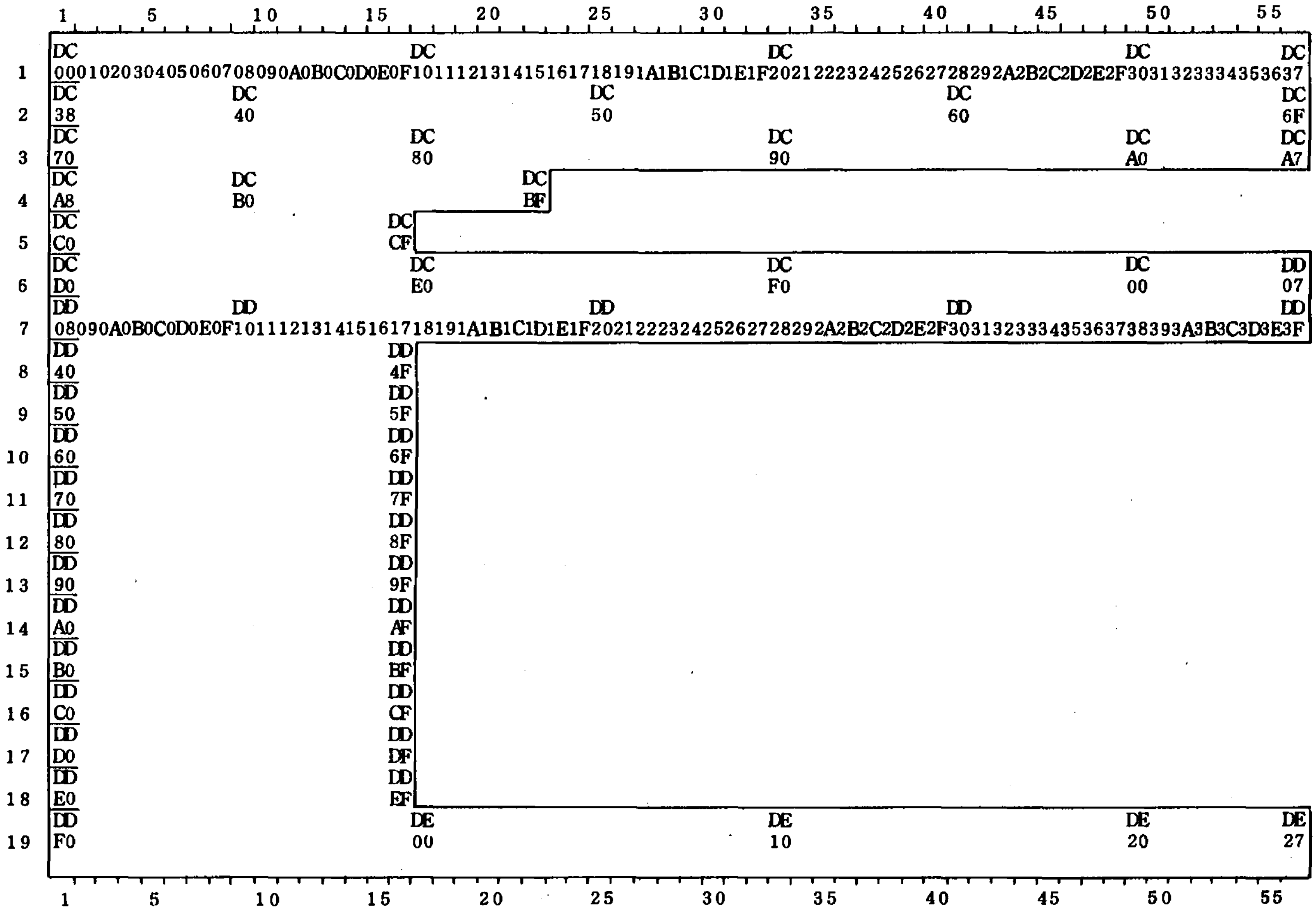


Fig. 8-7 TR4172 Display Address

Table 8-6 TR4172 alphanumeric character set vs. hex codes

	Normal	Large	End
p	00	40	80
A	01	41	81
B	02	42	82
C	03	43	83
D	04	44	84
E	05	45	85
F	06	46	86
G	07	47	87
H	08	48	88
I	09	49	89
J	0A	4A	8A
K	0B	4B	8B
L	0C	4C	8C
M	0D	4D	8D
N	0E	4E	8E
O	0F	4F	8F
P	10	50	90
Q	11	51	91
R	12	52	92
S	13	53	93
T	14	54	94
U	15	55	95
V	16	56	96
W	17	57	97
X	18	58	98
Y	19	59	99
Z	1A	5A	9A
_	1B	5B	9B
Ω	1C	5C	9C
k	1D	5D	9D
Δ	1E	5E	9E
m	1F	5F	9F

	Normal	Large	End
blank	20	60	A0
n	21	61	A1
'	22	62	A2
#	23	63	A3
j	24	64	A4
%	25	65	A5
z	26	66	A6
°	27	67	A7
d	28	68	A8
µ	29	69	A9
*	2A	6A	AA
+	2B	6B	AB
,	2C	6C	AC
-	2D	6D	AD
.	2E	6E	AE
/	2F	6F	AF
0	30	70	B0
1	31	71	B1
2	32	72	B2
3	33	73	B3
4	34	74	B4
5	35	75	B5
6	36	76	B6
7	37	77	B7
8	38	78	B8
9	39	79	B9
:	3A	7A	BA
s	3B	7B	BB
<	3C	7C	BC
=	3D	7D	BD
>	3E	7E	BE
?	3F	7F	BF

8-15. CONNECTION TO PLOTTER (TR9834R)

This section describes attachment of TR9834R Plotter to the TR4172 Analyzer.

First, connect the GPIB connector on the rear of the TR4172 to that on the TR9834R with the supplied GPIB cable. Then set the TR9834R to the LISTEN ONLY mode and power it up.

After setting up all measurement conditions on the TR4172, press [SHIFT] [LABEL] [Δ]Q. If the frequency axis is in the logarithmic scaling (see Section 4-14-8), however, press only [Δ]Q key. The diplay will show the following message:

'1' TR9831

'2' TR9834R

'0' QUIT

Press the Data key 2. The message displayed on the screen will change as shown below. If a TR9831 is connected to the TR4172, press the key 1. Pressing the key 0 returns the TR4172 to the status it was in before the [SHIFT] [LABEL] [Δ]Q switch was depressed.

PLOT

'1' LARGE

'2' SMALL

'0' QUIT

Press the Data key 1 (LARGE) to plot display data (waveforms, graticules, characters, markers, and labels) in A3 size, the key 2 (SMALL) to plot it in A4 size (size of this instruction manual).

Pressing the key 0 will return the TR4172 to the status it was in before the [SHIFT] [LABEL] [Δ]Q switch was depressed. Where only character text, such as HELP messages, is displayed, plotting starts immediately. On a normal screen display, the following message appears after the LARGE/SMALL select switch is pressed.

PLOT

'1' ALL

'2' TRACE

'0' QUIT

Press the Data key 1 (ALL) to plot all display data, and the key 2 (TRACE) to plot waveforms only. The key 2 can be used to overlay a new waveform over previously plotted data.

Pressing the key 0 (QUIT) will return the TR4172 to the status it was in before the [SHIFT] [LABEL] [Δ]Q switch was depressed.

After the ALL/TRASE select switch is pressed, the characters that had been displayed in the active area prior to the display of the above message are displayed again and plotting begins.

Pressing the key 0 during plotting cancels the plotting operation causing the initial PLOT message to be displayed.

After plotting, a single-page feed occurs unless only a waveform has been plotted. When a waveform is to be overlaid over previously plotted data, only the waveform should be plotted first.

The TR9834R Plotter can be operated in either one pen or two pen mode. Text information, graticule, and contents of memories A and A' are plotted by pen 1, while the contents of memories B and B' are plotted by pen 2. The contents of blanked memory will not be plotted, however. In the BOTH display mode, images A and B may be plotted in different colors if different color pens are used for pens 1 and 2.

When the TR9834R Plotter is attached to the TR4172 Analyzer, the TR4172 functions as a controller for the TR9834R. Therefore, no other devices or controller should, in principle, be attached to the TR4172.

When in the single display mode, signal response trace and graticule may be plotted in different colors if trace information is stored in memory B.

When using two pens, calibrate their relative positions by referring to the TR9834R Instruction Manual.

The recording paper for the TR9834R is available in roll and leaf papers. When leaf paper is to be used, the pen(s) may not automatically return to its (their) home position upon completion of plotting, with the REMOTE and PROMPT lamps flashing. If this occurs, press the position switches on the TR9834R to return the pen to its home position.

8-16. CONNECTION TO PLOTTER (TR9831)

Connection and operating procedures are the same as those of TR9834R. However, power the instrument on while the TR9831 FEED switch is being pressed.

The TR9831 allows the selective use of four pens, pens 1, 2, 3 and 4. Among the TR4172 display data, characters and graticules are plotted with pen 1 and the contents of traces A, B, A' and B' are plotted with pens 1, 2, 3 and 4 respectively. Blank traces are not plotted. (See Table 8-5.)

The following message is displayed when plotting with the TR9831 is disabled:

(ERROR) PLOTTER DOWN OR CONNECTOR DRAWN OUT
'1' COUTINUE
'0' QUIT

Table 8-5 Display data and pen correspondence

TR4172 display data	TR9831	TR9834R
Trace A	Pen 1	Pen 1
Trace B	Pen 2	Pen 2
Trace A'	Pen 3	Pen 1
Trace B'	Pen 4	Pen 2
Graticules	Pen 1	Pen 1
Characters	Pen 1	Pen 1

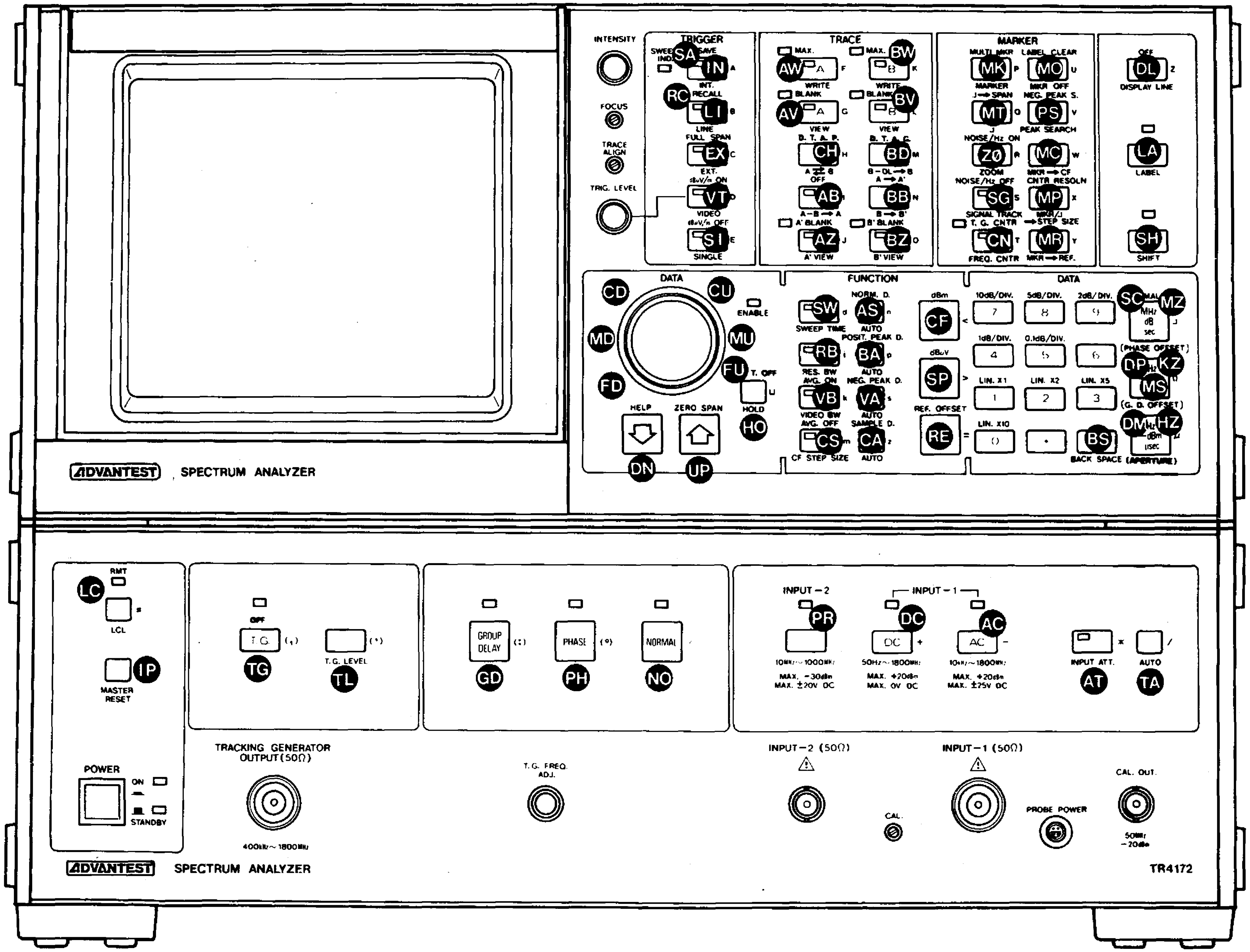


Fig 8 - 4 BPIB Command

SECTION 9

IMPEDANCE MEASUREMENT

9-1. GENERAL

The TR4172, when combined with the VSWR bridge, provides a Smith chart display on the TR4172's CRT display to allow for impedance measurement. It also permits direct readout of VSWR, reflection coeficient, and normalized impedance values useful for reflection wave analysis. In addition, the TR4172 makes various arithmetic and logical operating features using the internal CPU available for impedance measurement, offering the high-stability, high-sensitivity measurement for which the TR4172 is designed.

This section describes the theory of impedance measurement, the calibration procedure required for impedance measurement, and explains the impedance measurement procedure in some detail.

The impedance measurement mode is selected by pressing [SHIFT] [LABEL] [0]. Once this mode is selected, functions of the control keys on the front panel are different from the usual ones. The key functions available in this mode are listed in Figure 9-34.

9-2. THEORY OF OPERATION

When a VSWR bridge is connected across the TRACKING GENERATOR OUTPUT and INPUT-1 of the TR4172 Analyzer and a Device Under Test (DUT) is connected to the Analyzer via this VSWR bridge, a signal proportional to the reflection from the DUT is input to INPUT-1. If the DUT terminals on the bridge are shorted or open (full reflection), the input to the INPUT-1 is maximized; if a characteristic impedance of the bridge is connected to the DUT terminals, then the input to INPUT-1 is minimized.

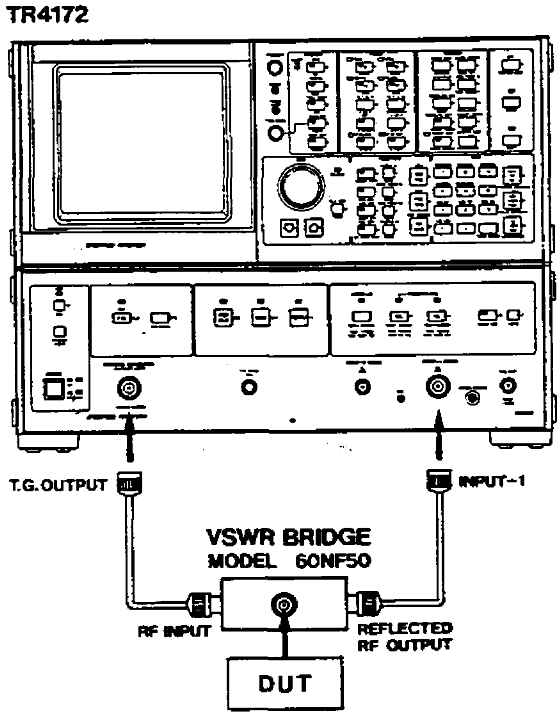


Fig. 9-1 Impedance measurement setup

The return loss of the DUT (difference between the reflection from the DUT and full reflection) can be determined by reading the input level on a logarithmic scale. If the input amplitude is displayed on a linear scale and the reference level is set to the full reflection level, the reflection coefficient can be directly read out at a resolution of 0.1 div. Furthermore, the reflection coefficient can be handled as a vector by phase measurement.
Figure 9-2 shows how the TR4172 reads phase information upon the first sweep, then reads amplitude information of linear scale upon the second sweep.

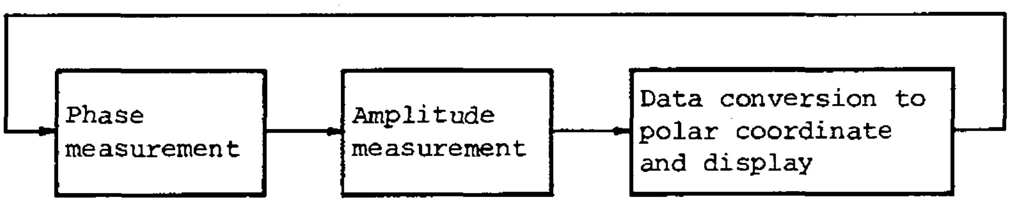


Fig. 9-2 Impedance measurement and display information flow

The information is then translated into polar coordinate data by arithmetic operation and displayed on the monitor (see Figure 9-3). Figure 9-4 shows amplitude, phase, and polar-coordinate displays for the same device under test.

A normalized impedance value can be read by superimposing a Smith chart on the reflection coefficient data displayed on a polar coordinate. Since the TR4172 can show a Smith chart on the display, approximated normalized impedance can be read from the display.

When a marker is used, the marker frequency, VSWR, reflection factor, phase, and normalization impedance are digitally displayed. For the TR4172, transfer characteristics can be displayed with vectors using only the polar-coordinate display function. In this case, directly connect DUT between TRACKING GENERATOR OUTPUT and INPUT-1.

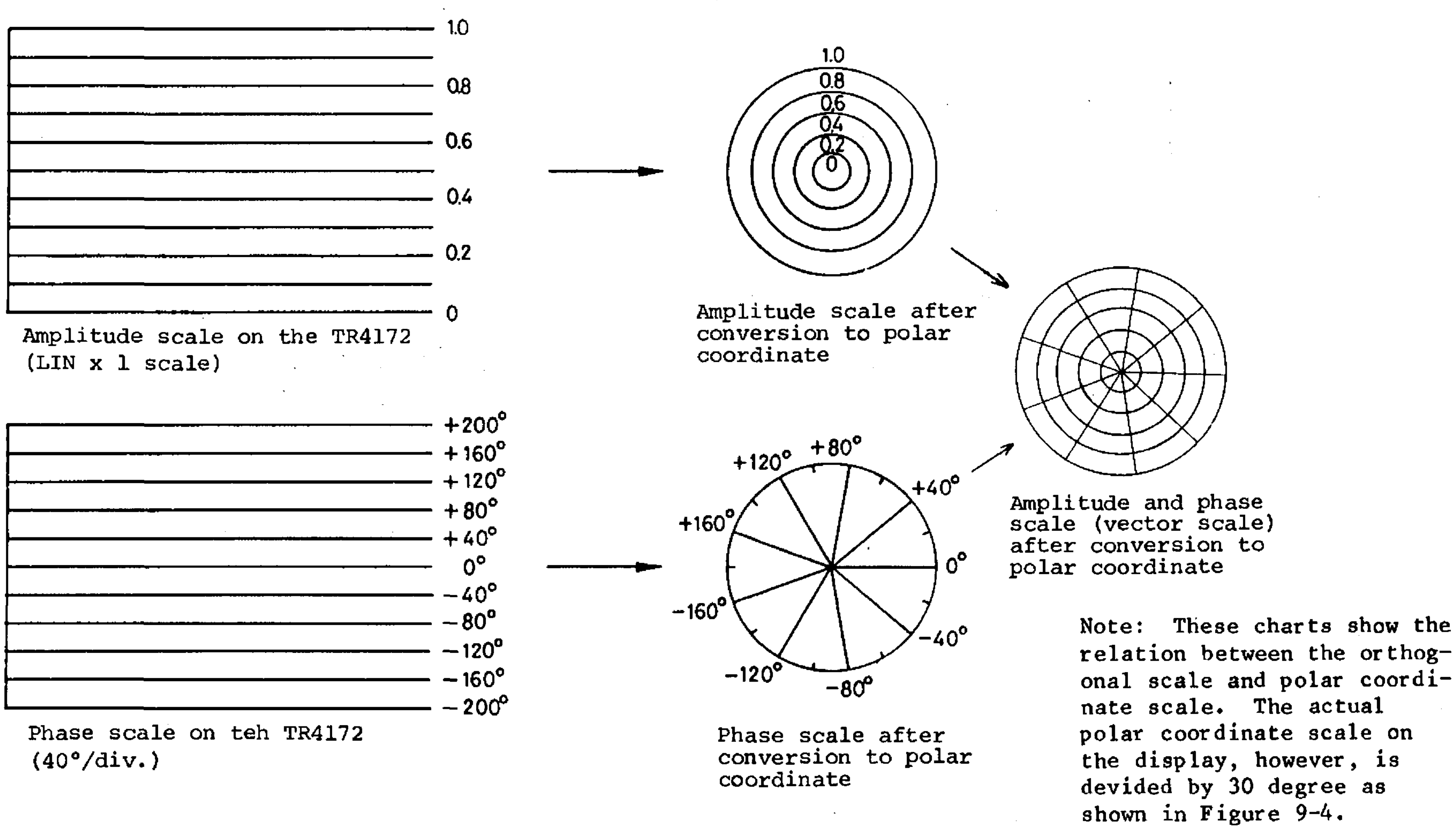
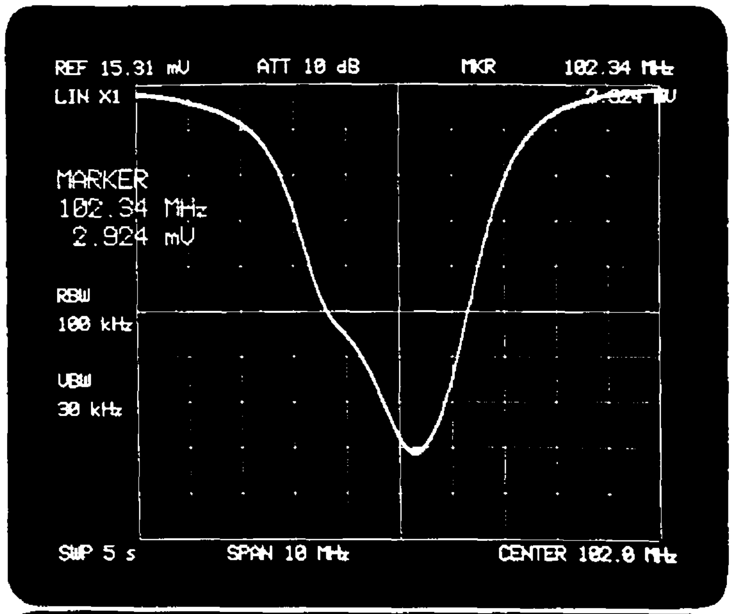
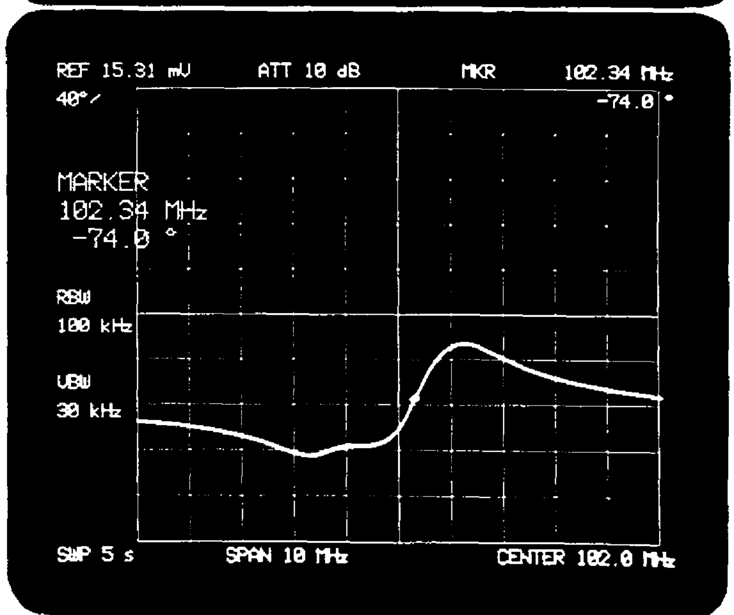


Fig. 9-3 Amplitude and phase information translated into polar coordinate data

Amplitude display



Phase display



Polar coordinate display

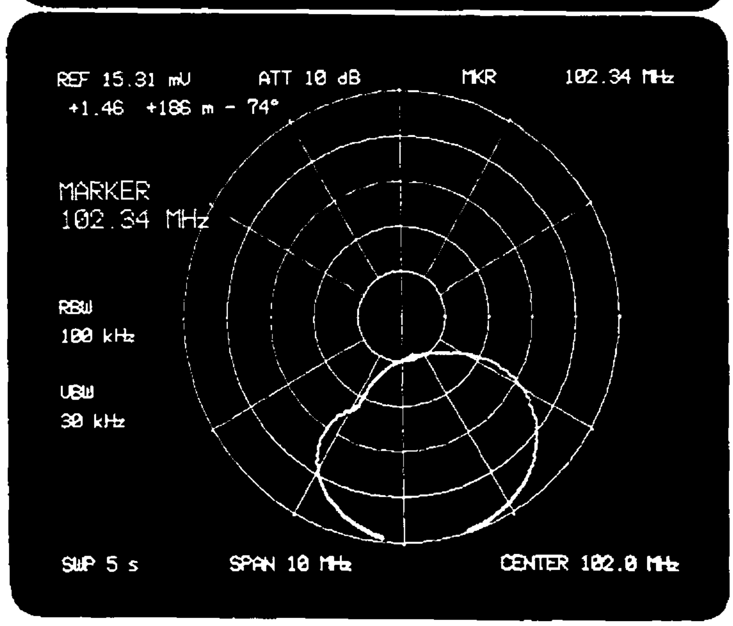


Fig. 9-4 Amplitude, phase, and polar-coordinate displays for the same DUT

9-3. CALIBRATION

9-3-1. General

When measuring impedance or reflection-coefficient using a VSWR bridge, calibration must be done to cancel the loss of the VSWR bridge, electrical length of the cable, and other error factors. For this calibration, a short or open plug is connected to the DUT terminals on the VSWR bridge instead of a real DUT, and the reference level, group delay offset, and phase offset are adjusted so the display data comes to the 0 Ω or ∞ Ω point on the Smith chart. When a frequency span of several 10 MHz or more is selected, however, satisfactory calibration may not be possible due to the nonlinear frequency response of the tracking generator or VSWR bridge. In order to solve this problem, the TR4172 contains a frequency response correction feature for both amplitude and phase. Since calibration directly affects measurement accuracy, the open or short plugs used should have nearly ideal characteristics in the given frequency range.

9-3-2. Preparation for Calibration

Connect the VSWR bridge across the TRACKING GENERATOR OUTPUT and INPUT -1 of the TR4172 by means of interconnecting cables DGM010-00150EE (see Figure 9-5).

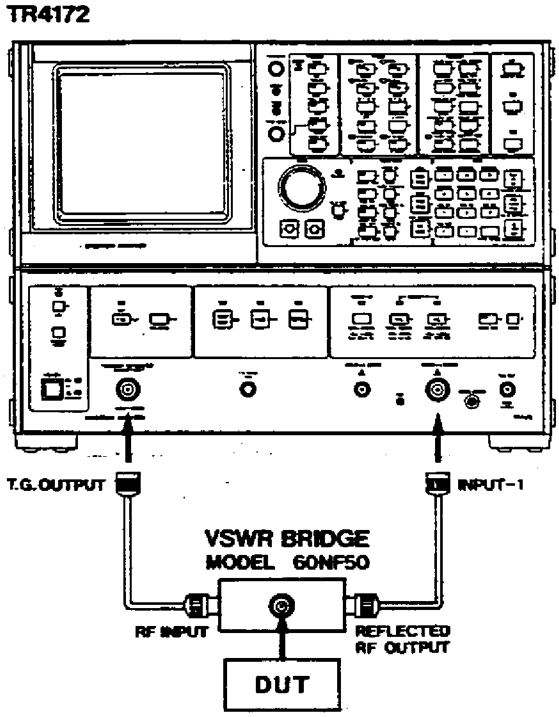


Fig. 9-5 Calibration system setup

The recommended VSWR bridge is 60NF50.
Connect the DUT across the terminals on the VSWR bridge, then press the TG key to activate the tracking generator output. While viewing the pass-band response of the DUT, set up the center frequency, frequency span, and other necessary parameters. Use the TG LEVEL key to adjust the signal level applied to the DUT. The signal level actually applied to the DUT is 6 dB to 7 dB lower than the tracking generator output level (when the recommended VSWR bridge is used). Since impedance measurement involves phase measurement, press the SWEEP TIME key, then manually select the appropriate sweep time with the DATA knob or other control means.

9-3-3. Calibration Procedure

Disconnect the DUT from the terminals on the VSWR bridge, and connect an short or open device to the terminals. If the DUT is connected by a cable, leave the cable connected to the terminals, and connect the short or open device to the end of that cable. In some frequency area, an open connector has its own capacity. In this case, use a short connector.

Press the PHASE key to observe phase response, then adjust group delay offset with the kHz (G.D. OFFSET) key until phase rotation is cancelled out.

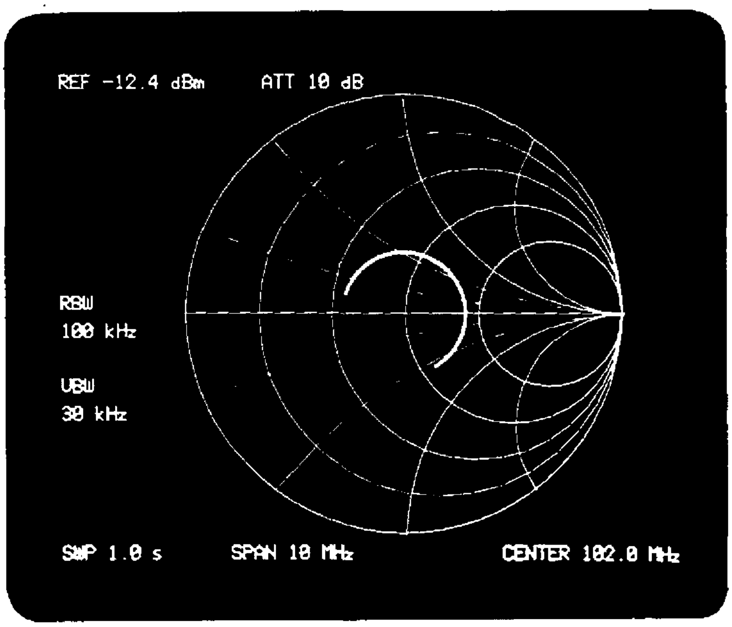


Fig. 9-6 Impedance measurement start

Press [ ] SHIFT [ ] LABEL [0] to activate the impedance measurement

Figure 9-6 shows a Smith chart on the display, and impedance measurement sweep is started to display the measurement information translated into polar coordinate data. The display information is updated every other sweep.

The center frequency, frequency span, and other parameters set up during preparation are also maintained during impedance measurement. Press the REF LEVEL key, then use the DATA knob to align the measurement information to the outermost circumference of the Smith chart.

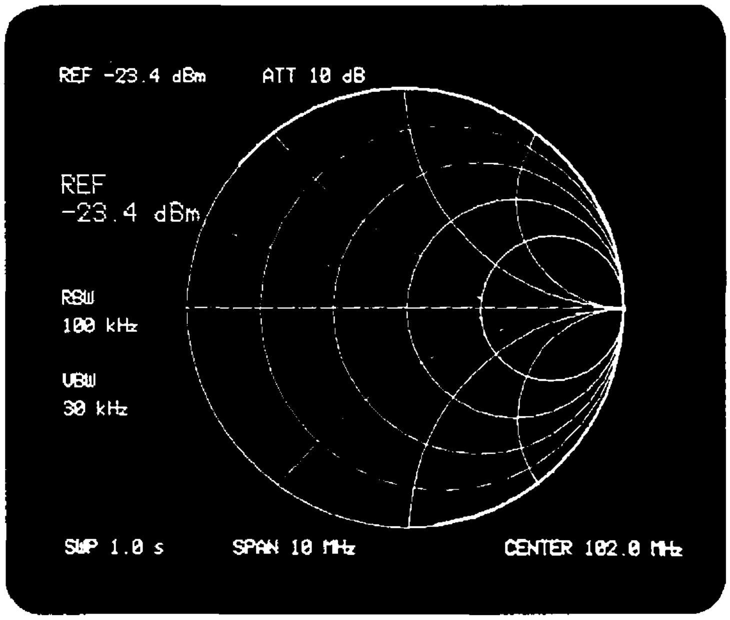
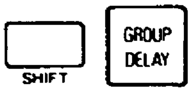


Fig. 9-7 Positioning the display information to the outermost circumference of the Smith chart

Press 

, then use the DATA knob to converge the display data to as small a point as possible. For finer adjustment, press the kHz key before controlling the DATA knob. To prevent the bright data spot from burning the display screen, press the PEAK SEARCH (POINT DEC.) key several times to reduce the number of data points. As mentioned earlier, the impedance measurement mode causes the control keys on the front panel to have functions different from their normal functions. For those functions refer to Figure 9-34.

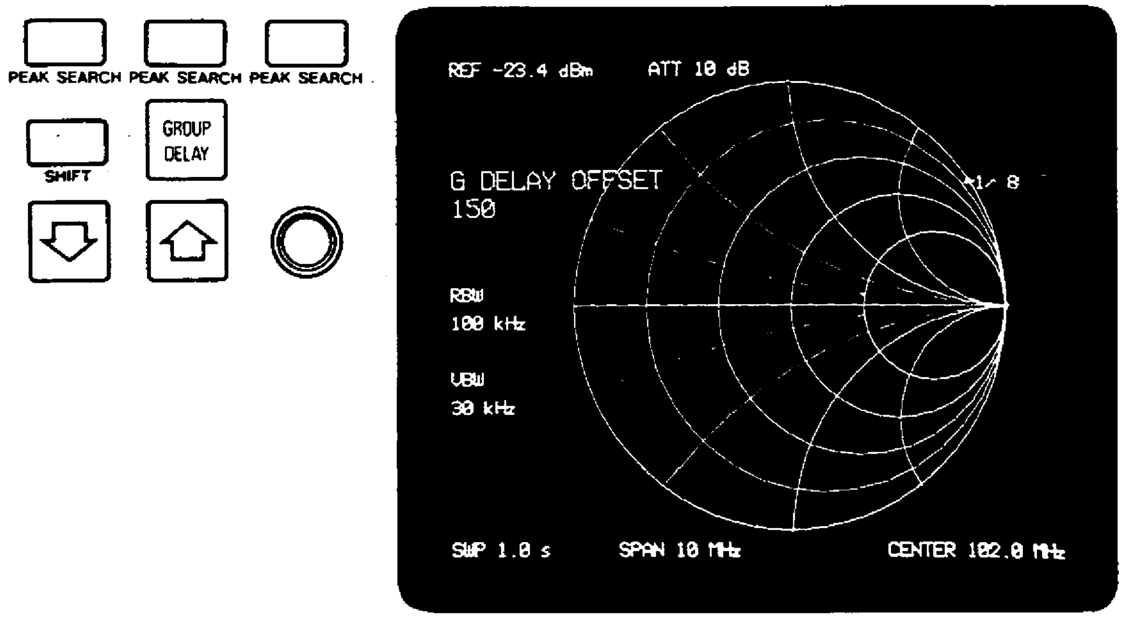


Fig. 9-8 Converging the display data to a small spot

Press SHIFT PHASE , then use the DATA knob and step keys to cancel phase offset. If an open device is connected to the DUT terminals on the VSWR bridge, position the data spot to the ∞ Ω point (right-hand end) on the Smith chart. If a short device is connected to the terminals, position the data spot to the 0 Ω point (left side) of the Smith chart.

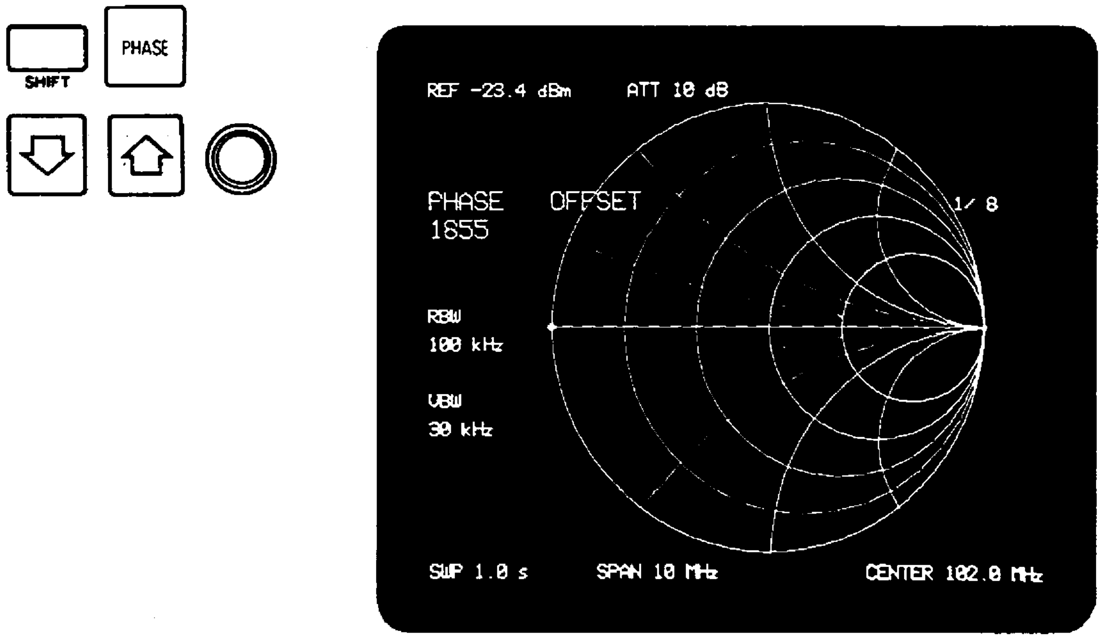


Fig. 9-9 Calibration for DUT terminal open

Fig. 9-10 Calibration for DUT terminal shorted

Calibration has now been completed. The same calibration procedure may be used for the amplitude and phase measurement mode while viewing the orthogonal coordinate (and by using the relationship shown in Figure 9-3). In this case, calibration time will be shortened since display updating interval for the orthogonal coordinate is shorter than that for the Smith chart.

9-3-4. Correcting frequency characteristics (Normalization)

This frequency correction mode allows correction data measured by A WRITE to be used for B WRITE as well, because it does not go through A-B → A unlike the normalize mode that is effected by [SHIFT], [MHz dB sec].

In this correction mode, waveform data on 0 to 2,000 MHz (1,001 points) is stored as reference waveform data. Accordingly, even if the setting of [CENT. FREQ.] or [FREQ. SPAN] is altered, the corrected value can be calculated from the 1,000 points of waveform data to continue with normalization. The narrower the span, however, the coarser becomes the corrected value. To use reference waveform data, set the POWER switch to STANDBY. The reference waveform data can be erased by pressing the MASTER RESET key and performing a vertical axis scale change operation.

Note: This function is not operative while the screen vertical axis is Tl dB/DIV., 0.5 dB/DIV, 0.2 dB/DIV., or 0.1 dB/DIV and the TR4172 is in the PHASE or GROUP DELAY mode.

a. Storing reference waveform data and correcting frequency characteristics

① Set the TR4172 in the TG mode, then in the A WRITE mode by pressing [A WRITE].

② Interconnect the TRACKING GENERATOR OUTPUT connector and the INPUT-1 connector directly with the supplied cable MI-04.

③ After setting CENT.FREQ. to 1000 MHz and FREQ.SPAN to 2000 MHz, lower the reference level to confine the through waveform within the grid in the upper part of the screen.

(4) Press [SHIFT], [LABEL], [ ]M, and the frequency characteristics are corrected on the basis of the 50 MHz level of the through waveform. The range of correction is + 120 points of the 50 MHz level. At this time, the reference waveform data is stored in memory.

Note: During this operation, the TR4172 is automatically set to A' BLANK, A WRITE, CENT.FREQ. 1000 MHz, and FREQ.SPAN 2000 MHz.

b. Switching corrected frequency characteristics automatically or manually

Press [SHIFT], [LABEL], [ ]I, and the following messages will be displayed:

FREQ. CHARACT. CORR.
'1' HAND OPERATED
'0' AUTO CORR

If you press the numeric keypad key [1], even though the setting of CENT.FREQ. or FREQ.SPAN is altered, the corrected values can be calculated by pressing [SHIFT], [•] after the change to continue with normalization.

If you press the numeric keypad key [0], the corrected values are calculated each time the setting of CENT.FREQ. or FREQ.SPAN is altered, thus allowing continued normalization.

c. Selecting or deselecting corrected frequency characteristics

Press [SHIFT], [LABEL], [ ]J, and the following messages will be displayed:

FREQ. CHARACT. CORR.
'1' DO NOT USE CORR.
'0' USE CORR.

If you press the numeric keypad key [1], the correction of frequency characteristics is suppressed.

If you press the numeric keypad key [0], corrected values are calculated from the reference waveform data stored in memory to set the TR4172 in the normalize mode.

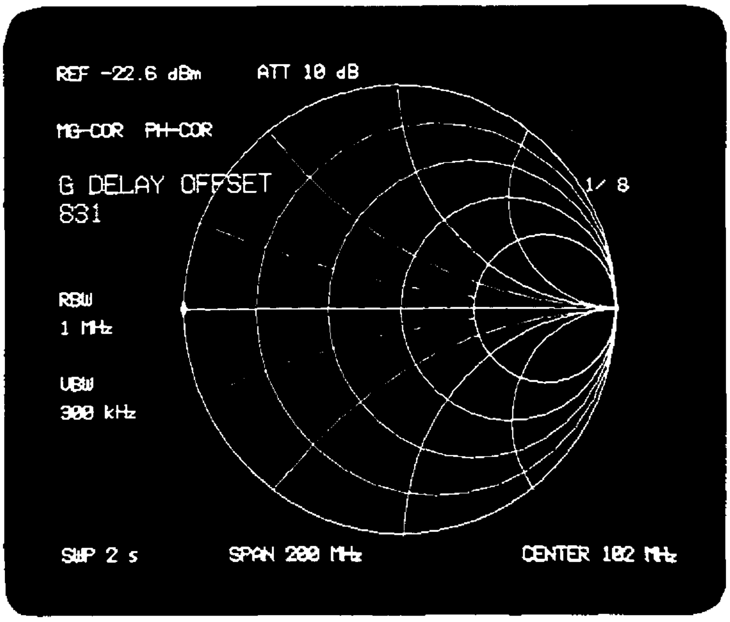


Fig. 9-11 Frequency response correction in the amplitude domain

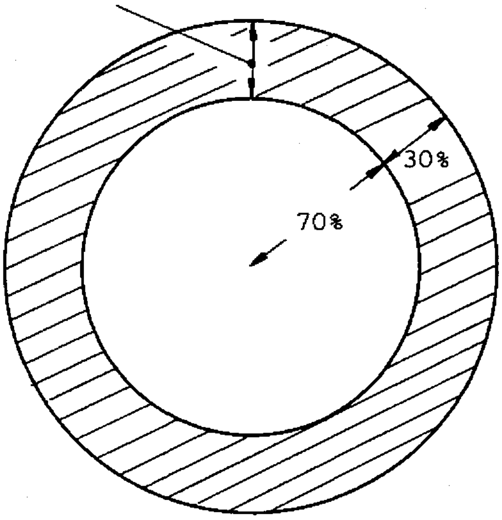


Fig. 9-12 Amplitude-frequency response correctable range

9-3-5. Calibration in Enlargement Mode

The center portion of a Smith chart display can be enlarged 10 times by pressing the ☐* (MAG. x 10) key. The enlargement will result in a slight phase error. To cancel this phase error, connect an open or short device to the DUT terminals on the VSWR bridge, and adjust phase offset so that the phase is 0° for an open terminal or 180° for a shorted terminal. When the display data overscale, that is unimportant.
If the ☐* (MAG. x 10) key is pressed again, the Smith chart display of normal size will be restored. In this case also, carry out phase calibration. If the slight phase error occurring in the enlargement mode is insignificant, the phase calibration may be omitted.

9-4. MEASUREMENT

9-4-1. Measuring Procedure

Accurate calibration is a vital factor for precision impedance measurement. Once calibration is completed, do not change the center frequency, frequency span, reference level, or other parameter setting. If any change is effected on these parameters, carry out calibration again.
After completing calibration, connect the DUT across the DUT terminals on the VSWR bridge. The impedance of the DUT can now be read on the Smith chart display. Figures 9-13, 9-14, and 9-15 show the three types of scales used for this option. Figure 9-13 shows a Smith chart from which a normalized impedance can be read. The normalized impedance at the point indicated by a small mark "o" in this figure is read as $0.2\ \Omega\ -j0.5\ \Omega$. Figure 9-14 shows a polar coordinate from which a reflection coefficient can be determined. The reflection coefficient at the point identified by small mark "o" in this figure is read as $0.8 \angle 60$ deg. Figure 9-15 shows another Smith chart whose center portion is enlarged tenfold. A normalized impedance in the vicinity of 1 can be determined from this chart at a high resolution. The normalized impedance at the point indicated by a small mark "o" in this figure is read as $1.1\Omega\ -j0.1\Omega$.

The impedance can be determined by multiplying the real and imaginary parts of the normalized impedance each by 50 (when the characteristic impedance of the bridge is 50 Ω).

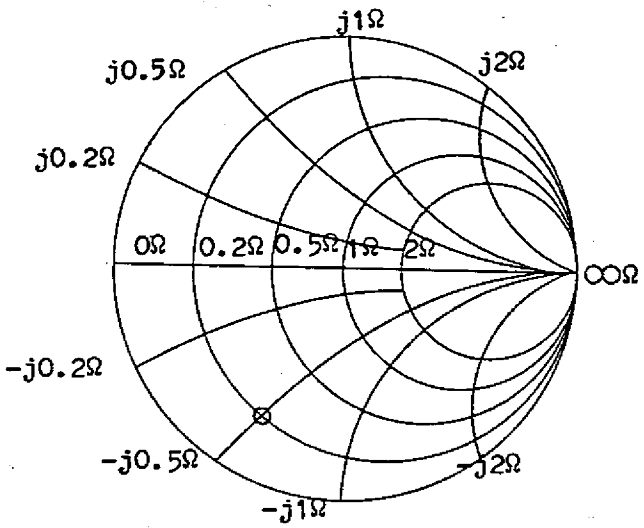


Fig. 9-13 Smith chart

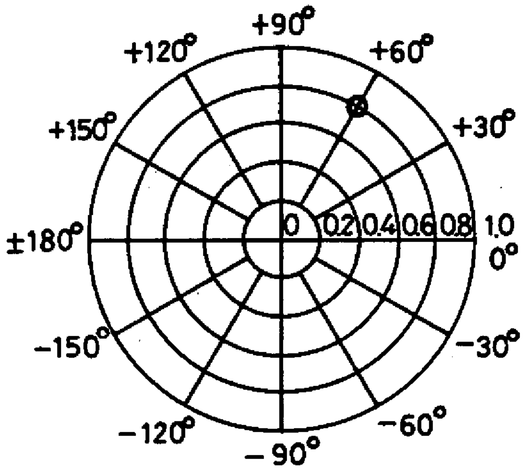


Fig. 9-14 Polar coordinate

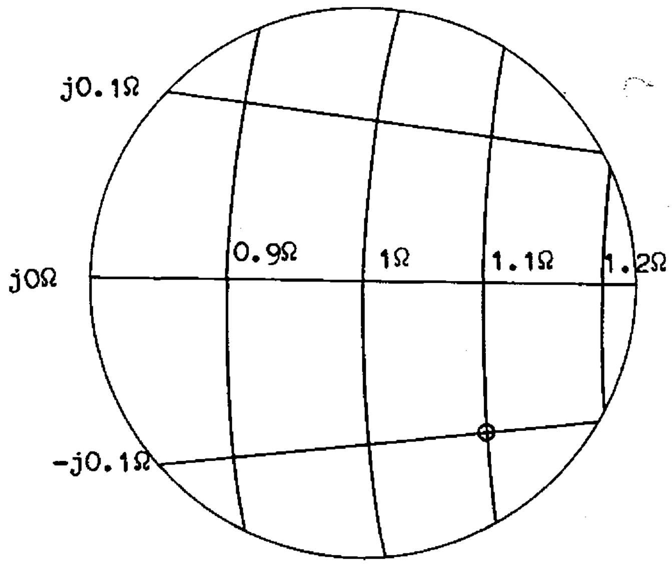


Fig. 9-15 Enlarged Smith chart

The frequency of the display data can be read with a marker activated by operating the [MARKER] key. In addition to the frequency, the display will also provide direct readouts for the VSWR, reflection coefficient, phase, normalized impedance, and inductance or capacitance of the equivalent serial circuit. The normalized impedance and inductance or capacitance of the equivalent serial circuit are not shown on the polar coordinate display, however. Figure 9-16 shows a data display example using a marker. Calculated data readouts for the marker point are shown on the third line on the screen. The readouts are VSWR, reflection coefficient, phase, normalized impedance, and inductance or capacitance, from left to right. The top information line on the display is reserved for user-defined Label information. If no label is written in this area, however, the titles for the data readouts shown on the third line are shown on this top line instead. If even one character of label information is entered in this line, the title will not be shown. While normalized impedance, inductance, and capacitance each have three significant digits, it shoud be noted that they may include a large error if the real or imaginary part of the impedance to be measured is extremely large or extremely small with respect to the characteristic impedance.

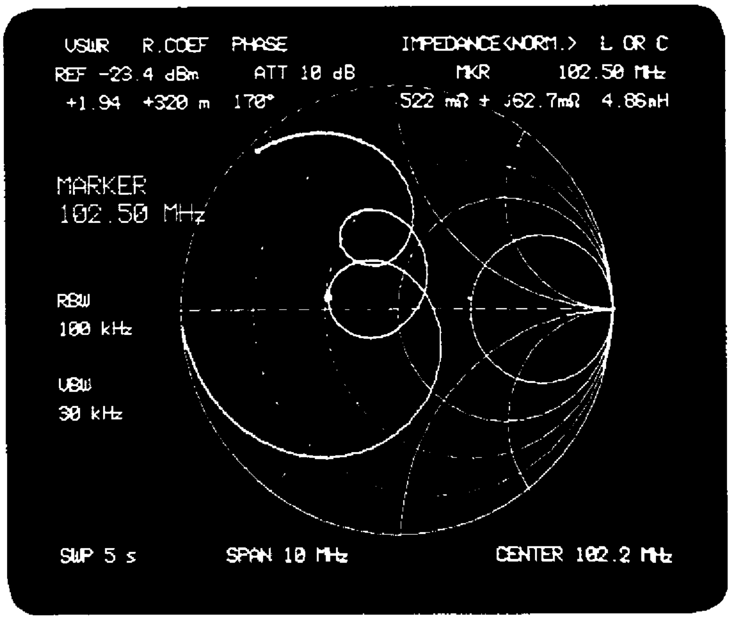


Fig. 9-16 Data readout for marker point

The data redouts for the marker point are updated every other sweep. If the measurement information is held with the [A] (VIEW) key, however the data readouts will be updated with marker movement.

The measurement information hold state can be cleared by pressing the [A] F (CLEAR WRITE) key.

As with the normal measurement mode, the center frequency, frequency span, reference level, and marker can be set up with any of the DATA knob, DATA step keys, and numeric data keyboard.

To clear the impedance measurement mode, press the [B] K (EXIT) key. At this time, the center frequency, frequency span, and other parameter setup are left intact, so that data comparison can be easily made between the normal mode and impedance measurement mode (e.g. a return loss is measured on the logarithmic scale, and the impedance is measured in the impedance measurement mode).

The basic impedance measuring procedure is described above. The following paragraphs describe various additional features available in the impedance measurement mode to facilitate measurement.

9-4-2. Usage of Additional Features

In the impedance measurement mode, there are some inoperative or unnecessary keys on the front panel. These keys are either made ineffective or assigned functions unique to this mode. (See figure 9-34.) Some keys with new function assignments are alternately activated and deactivated each time they are pressed. Some other keys are used to increment or decrement setup values (e.g. intensity) each time they are pressed. The lamps in these keys are not activated, but the setup conditions are shown on the display.
VSWR or reflection coefficient values are displayed with engineering units such as "m" or "k". For instance, 12.3 m means 0.0123.
The following paragraphs describe each additional function:

(1) Scale controlling function
A select the Smith chart, and B select the polar coordinate scales respectively. If the R (MAG. x 10) key is pressed when the Smith chart is selected, the reference level is reduced to one-tenth, and the center portion of the chart is enlarged tenhold. (See figure 9-17.) At this time, phase offset must be canceled if necessary. (See paragraph 9-3-5.) Pressing the R key again will restore the normal Smith chart and the original reference level.

(2) VIEW mode and impedance measurement mode clear
Operation of A G key stops sweep and holds measurement information on the display, so that photographing is facilitated. At this time, message "VIEW" will be shown in the right information area on the display. To clear the information hold state, press A F (CLEAR WRITE) key. Pressing B K (EXIT) key clears the impedance measurement mode and returns the instrument to the normal measurement mode.

R
ZOOM

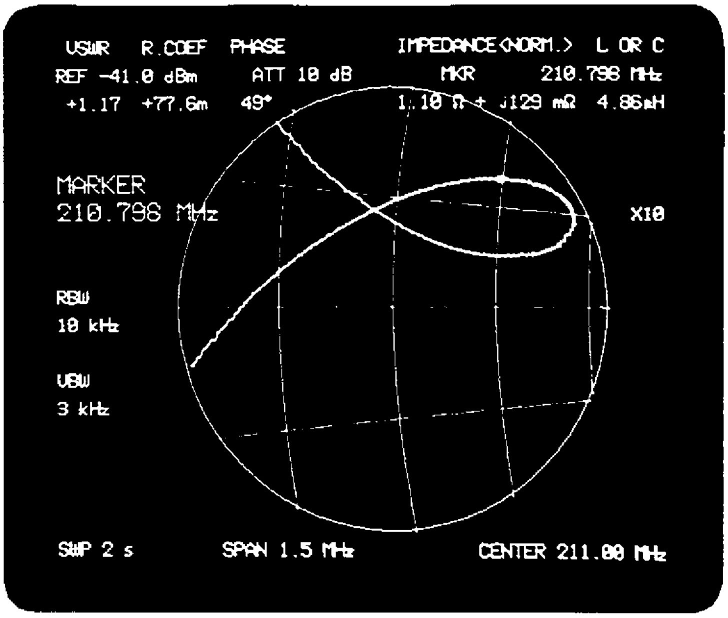


Fig. 9-17 Enlarged Smith Chart

(3) Increment and decrement of data points

Measurement data on the display usually consists of 500 data points. The number of data points can be reduced in half however, to 1/32 each time the v (POINTS DEC.) key is pressed. The reduction ratio is shown on the display as, for example, 1/16. To increase the number of data points, press the w (POINTS INC.) key. The number of data points is doubled each time this key is pressed. (See Figure 9-18.)

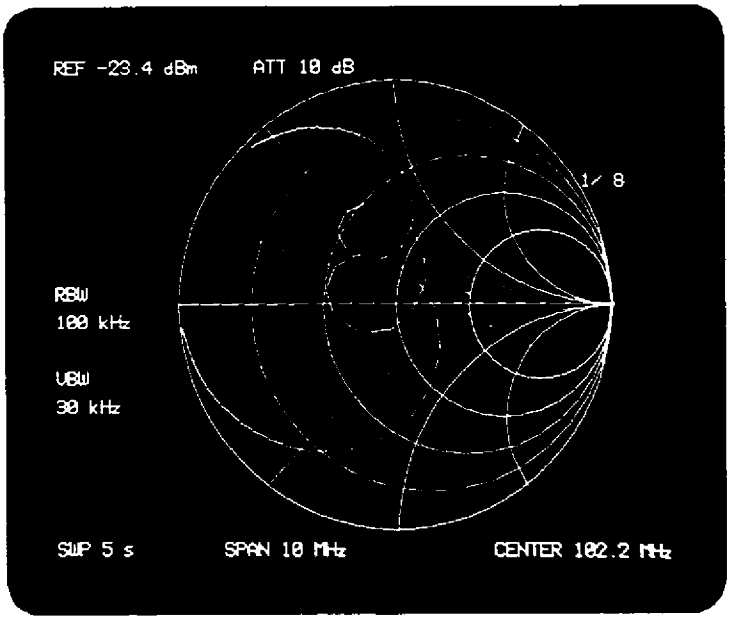


Fig. 9-18 Increment and decrement of data points

When measurement data is converged to one small spot on the display, reduce the number of data points to prevent the CRT from spot burn. If the number of data points is reduced, the time required for polar coordinate translation can be reduced accordingly.

(4) Reading numeric values from measurement data

In addition to markers, display cirlces, and start and stop markers can be used to read numeric values from measurement data. Pressing [ ]Z (DISP. CIRCLE) draws a concentric circle with respect to a specified coordinate location, with the message 'DISPLAY CIRCLE' appearing on the screen. The radius of this circle can be altered using ◯ or [⇩] [⇧]. When the radius of the circle is altered, the VSWR and the reflection coefficient corresponding to its circumference are displayed in the lower left corner of the CTR screen.

Pressing [ ]Z (DISP. CIRCLE) again turns off the display circle.

Pressing [□B]L (START STOP) displays the start and stop

frequencies of the sweep, with the message 'START STOP' appearing on the screen. In a regular rectangular coordinate system, the start frequency corresponds to the leftmost end of the frequency axis, and the stop frequency corresponds to the rightmost end of the frequency axis. At the same time, triangular markers point to the start and stop points. The start and stop points are indicated by an acute-angled triangle and an obtuse-angled triangle, respectively.

Pressing B L (START STOP) again erases these marekers.

The Y key causes the display circle to overlap the marker.

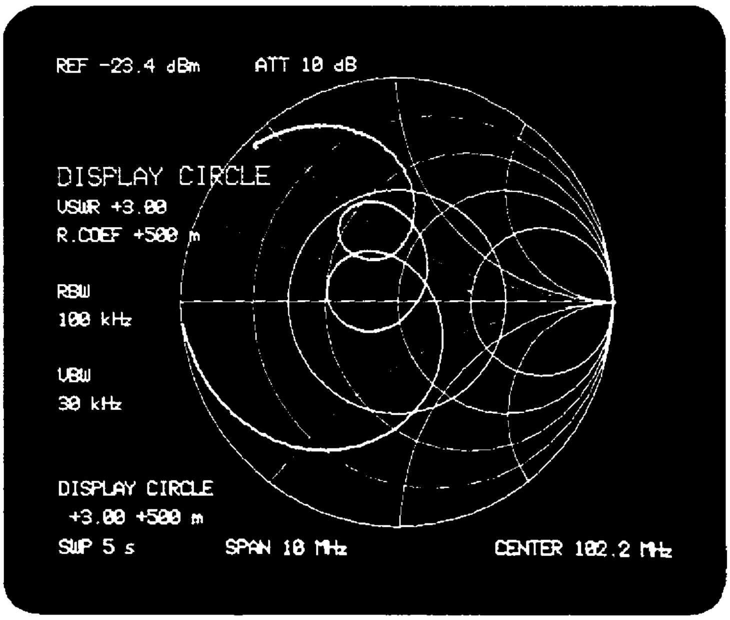


Fig. 9-19 Display circle

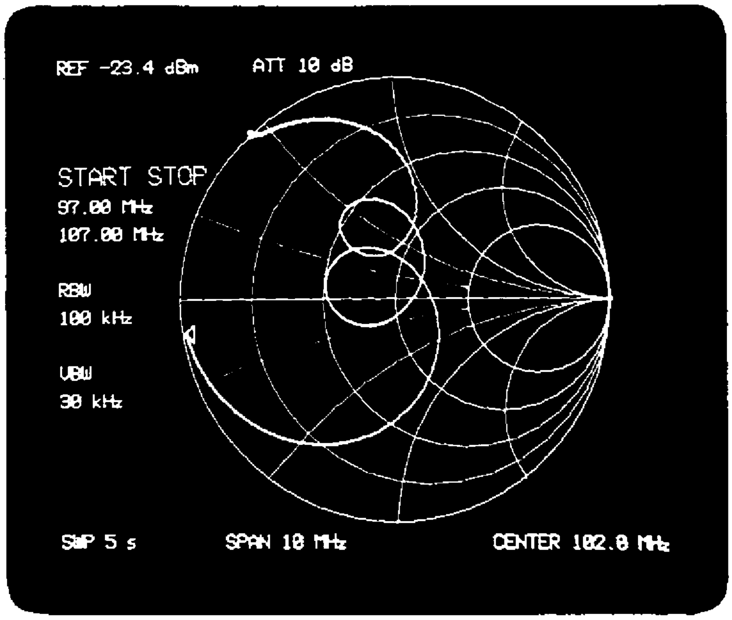


Fig. 9-20 Start and Stop markers

(5) Multimarker listing function

Multimarker setting is effected by following the same procedure as in normal mode. When a number of markers are displayed with the multimarker, pressing the [ ]M switch allows the values of the frequency, normalized impedance, and serial equivalent inductance or capacitance at up to 10 marker points to be listed on the display. The active marker is identified by an asterisk (*) to the left of its point number. If a display circle has been displayed, "IN" or "OUT" indicates whether a marker point has entered the circle or not.

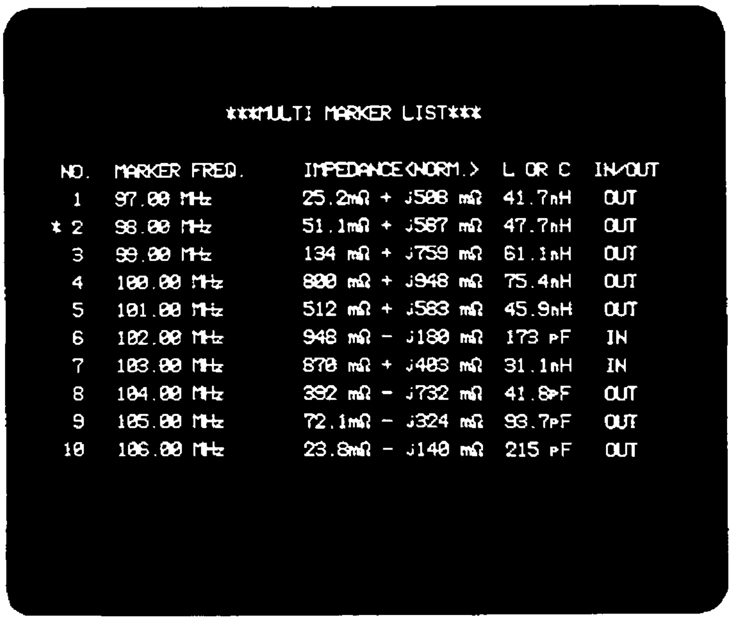
Pressing the [ ]M switch here displays a list of VSWR values, reflection coefficients, and phases.

Pressing the [ ]M switch next will cancel this mode.

Be sure to press the [A] VIEW switch to hold measurement data before entering this mode.

M

B−DL→B

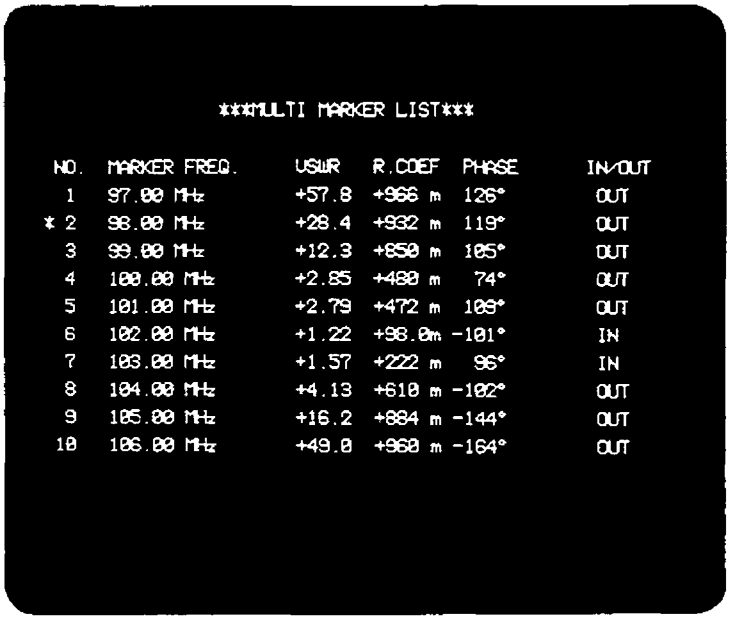


MULTI MARKER LIST

NO.	MARKER FREQ.	IMPEDANCE(NORM.)	L OR C	IN/OUT
1	97.00 MHz	25.2mΩ + j508 mΩ	41.7nH	OUT
* 2	98.00 MHz	51.1mΩ + j587 mΩ	47.7nH	OUT
3	99.00 MHz	134 mΩ + j759 mΩ	61.1nH	OUT
4	100.00 MHz	800 mΩ + j948 mΩ	75.4nH	OUT
5	101.00 MHz	512 mΩ + j583 mΩ	45.9nH	OUT
6	102.00 MHz	948 mΩ − j180 mΩ	173 pF	IN
7	103.00 MHz	870 mΩ + j403 mΩ	31.1nH	IN
8	104.00 MHz	392 mΩ − j732 mΩ	41.8pF	OUT
9	105.00 MHz	72.1mΩ − j324 mΩ	93.7pF	OUT
10	106.00 MHz	23.8mΩ − j140 mΩ	215 pF	OUT

Fig. 9-21 Normalized impedance and L/C listing

M



MULTI MARKER LIST

NO.	MARKER FREQ.	VSWR	R.COEF	PHASE	IN/OUT
1	97.00 MHz	+57.8	+966 m	126°	OUT
* 2	98.00 MHz	+28.4	+932 m	119°	OUT
3	99.00 MHz	+12.3	+850 m	105°	OUT
4	100.00 MHz	+2.85	+480 m	74°	OUT
5	101.00 MHz	+2.79	+472 m	109°	OUT
6	102.00 MHz	+1.22	+98.0m	−101°	IN
7	103.00 MHz	+1.57	+222 m	96°	IN
8	104.00 MHz	+4.13	+610 m	−102°	OUT
9	105.00 MHz	+16.2	+884 m	−144°	OUT
10	106.00 MHz	+49.0	+960 m	−164°	OUT

Fig. 9-22 VSWR, reflection coefficient, and phase listing

(6) Frequency response correction feature

This feature is used for pre-measurement calibration. Operation of the I (MAG. COR.) key selecters the amplitude frequency response correction mode. Pressing the J (MAG. CAL.) key effects calibration. If there is any data outside the correctable range, an error will result, with an ERROR message shown on the display. During calibration busy, the indicator "CAL" is also shown on the display. This correction mode is cleared by pressing the I (MAG. COR.) key again.

Operation of the N (PHASE COR.) key selects the phase frequency response correction mode. To execute calibration, press the O (PHASE CAL. (O)) key when the DUT terminals on the VSWR are open, and press the S (PHASE CAL (S)) key when the terminals are shorted. During calibration busy, indicator CAL <O> or CAL <S> is shown on the display. This correction mode is cleared by pressing the N (PHASE COR.) key again.

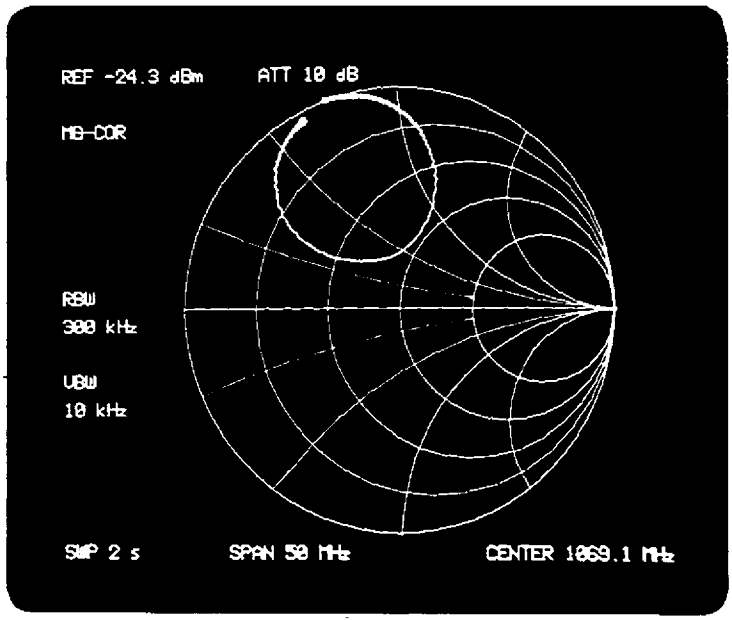


Fig. 9-23 Amplitude response correction mode

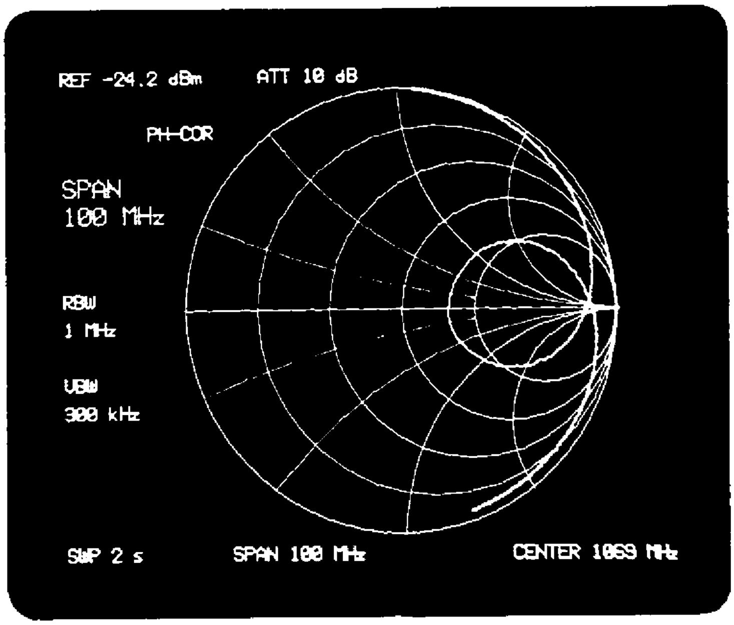


Fig. 9-24 Phase response correction mode

(7) Other features

Each operation of the [ ]T (CONTRAST) key increments only the intensity of the displayed impedance response trace or the graticule. The character information readouts remain at the same intensity. Operation of this key first increases the trace intensity in four levels; if the [ ]T (BRIGHT) key is pressed a fifth time, the intensity returns to the original level. Next, operation of this key increases the graticule brightness. This trace and graticule intensifying feature is convenient for highlighting the impedance response trace for photographing, or other occasions.

Operation of the [ ]K (HELP) key provides a listing of the special key functions used in the impedance measurement mode on the display (See Figure 9-25.)

Fig. 9-25 Key function listing for impedance measurement mode

9-4-3. Measurement Examples

This paragraph provides an example of application of the impedance measurement mode, with bandpass filter response measurement as an example.

① Connect the DUT (filter) across the TRACKING GENERATOR OUTPUT and INPUT-1 of the TR4172, then set up the necessary measuring parameters (such as center frequency, frequency span, etc.) observing the pass-band response in the normal mode.

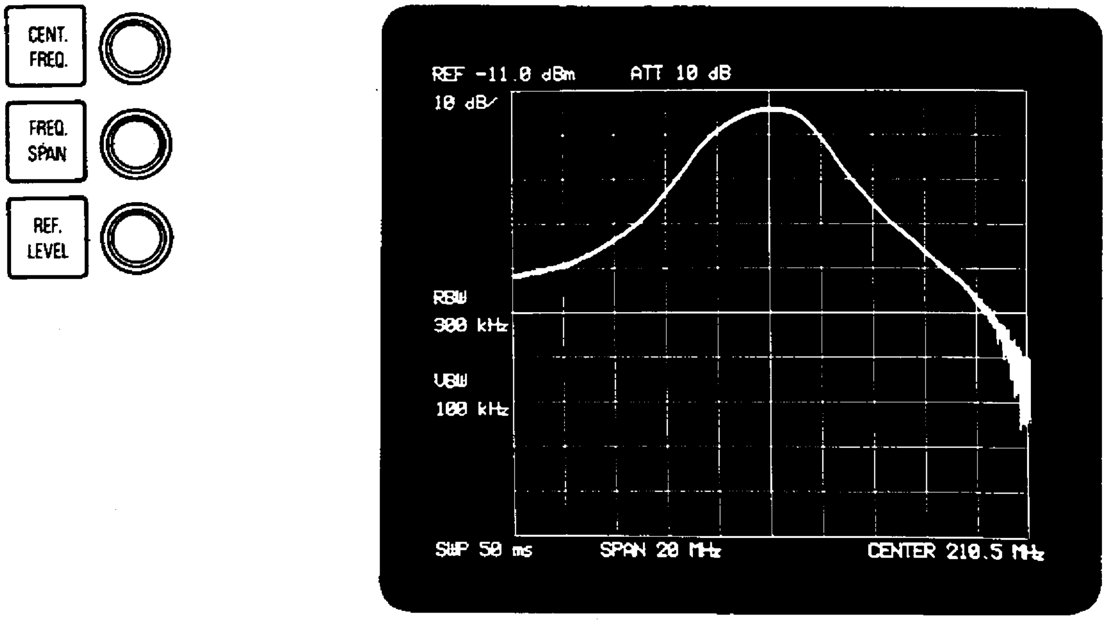


Fig. 9-26 Pass-band characteristic of band-pass filter

② Next, connect the VSWR bridge to the TR4172 instead of the DUT (filter) as shown in Figure 9-1, with the DUT left disconnected from the bridge. Activate a marker, and press the MKR→REF. key to position the signal response peak to the reference level.

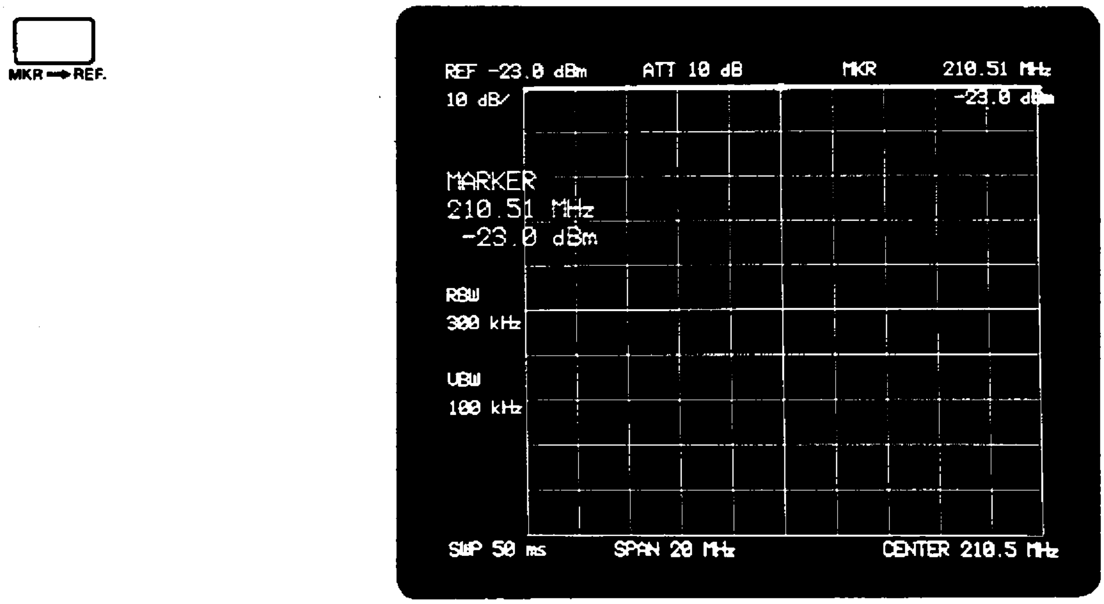


Fig. 9-27 Positioning the signal response peak to the reference level

(3) Connect the DUT to the VSWR bridge. The return loss of the DUT can be read out as the level difference from the reference level.

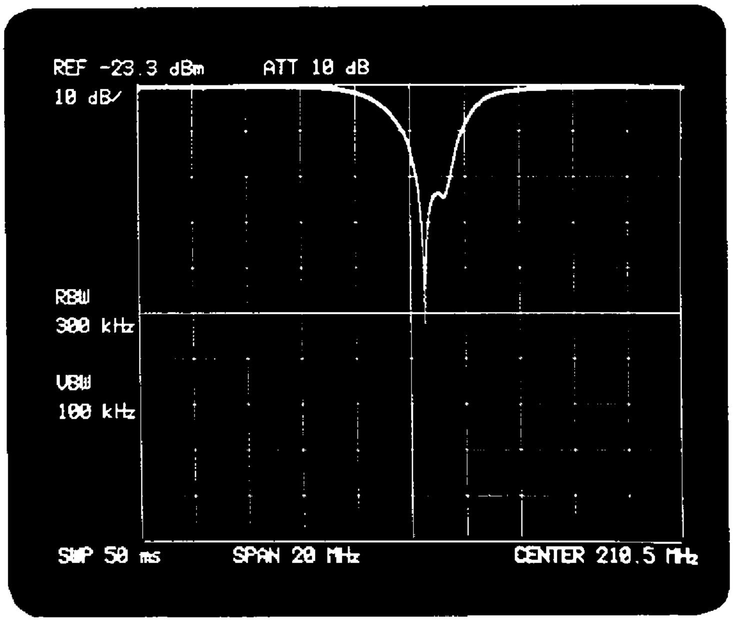


Fig. 9-28 Measurement of DUT return loss

(4) Disconnect the DUT from the VSWR bridge, and instead connect an open or shorting device to the DUT terminals on the bridge. (If the terminals are simply opened, the connector capacity will cause an error; therefore, it is preferable that a highquality open or shorting device be connected across the terminals.) Perform calibration according to the instructions in 9-3-2 and 9-3-3. Calibration in the impedance measurement mode is time consuming. To reduce this time, set the sweep time at a relatively small value to make course calibration, then set sweep time to the optimum value to perform fine calibration. It is also recommended that the $\boxed{}$v (POINTS DEC.) key be pressed several times in advance to reduce the number of data points and hence save calibration time. The calibration time may be further reduced if course calibration is done in the normal measurement mode (not in the impedance measurement mode) by utlizing the relationship shown in Figure 9-3.

(5) After completing calibration, connect the DUT to the DUT terminals on the VSWR bridge, allowing measurement on a Smith chart. While in the normal measurement mode frequencies can be read from the scale, in the normal measurement mode, on the Smith chart they are read by markers. It is recommended therefore, to use the Multi Marker mode in the impedance measurement mode. In the impedance measurement mode as well, up to 10 multi markers are available, which will be useful for photographing or copy to the plotter.

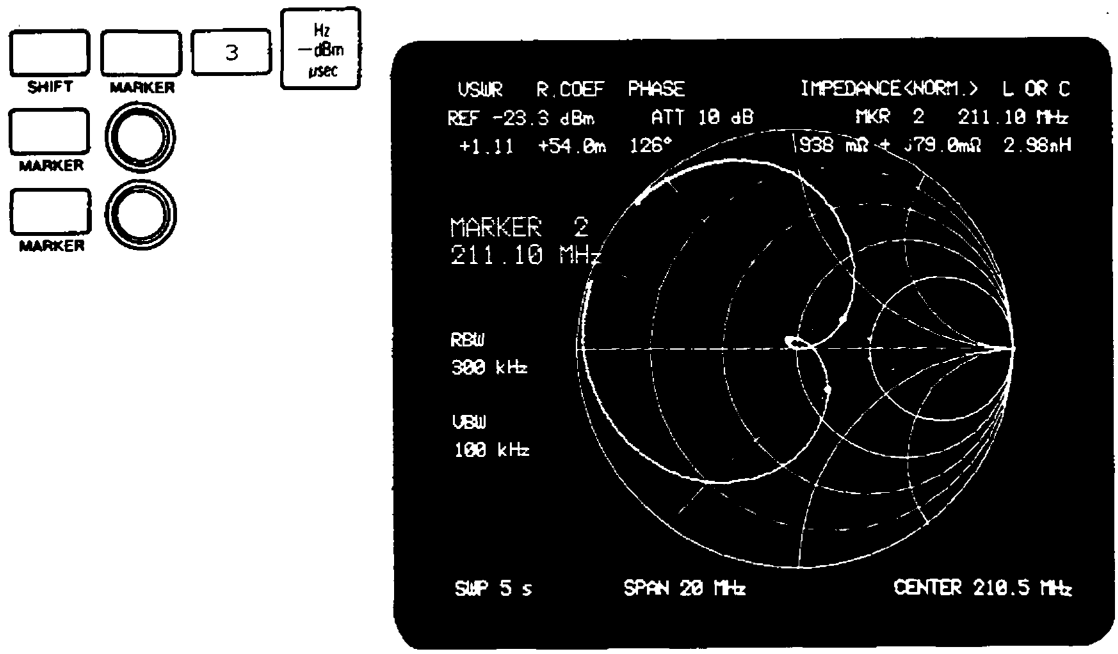


Fig. 9-29 Multi marker mode

(6) To clear the impedance measurement mode, press the [B] (EXIT) key. The return loss display can be restored by pressing the [NORMAL] key.

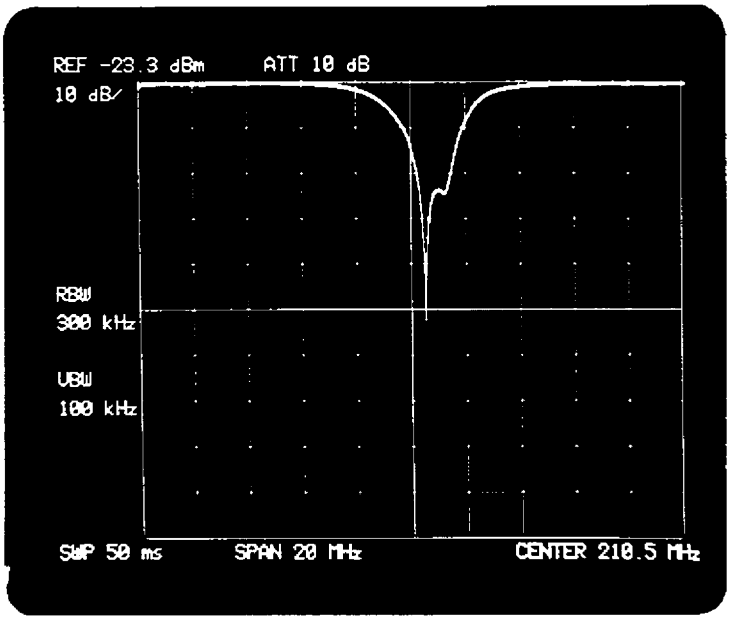


Fig. 9-30 Clearing the impedance measurement mode

9-4-4. Notes on Impedance Measurement

(1) The following keys have the same functions in both normal and impedance measurement modes:

- Function keys
- Data keys
- INPUT-1 (AC, DC)
- INPUT-2
- T.G. LEVEL
- INPUT ATT. and AUTO
- LABEL and SHIFT LABEL CLEAR
- MARKER and MKR. OFF
- Δ
- SHIFT MULTI MKR
- SHIFT GROUP DELAY (group delay offset)
- SHIFT PHASE (phase offset)
- SHIFT LABEL Δ (plotter)
- MASTER RESET
- LCL

All parameters set up with these keys are left intact, whether the impedance measurement mode is set or not. All other keys are assigned functions unique to the impedance measurement mode, or are made inoperative. In either case, the lamps in those keys are off.

The impedance measurement mode can be entered whether the preceding mode was the amplitude, phase, or group delay mode or the preceding scale was linear or logarithmic. When the impedance measurement mode is cleared, the original mode and scale are restored. For example, if the impedance measurement mode is selected with amplitude measurement of 5 dB/div. in the normal mode, the amplitude measurement mode at 5 dB/div. is restored when the impedance measurement mode is cleared. Similarly, if the phase measurement mode of 80 deg/div. was selected before the impedance measurement mode was selected, the same phase measurement mode of 80 deg/div. is restored when the impedance measurement mode is unset.

(2) When duplicating the display information on a plotter, press the $\boxed{\text{SHIFT}}$ $\boxed{\text{LABEL}}$ $\boxed{4}$ $\boxed{1}$ keys in the impedance measurement mode. All impedance measurement control functions can be remotely controlled over the GPIB. For example, an SH LA 0 sent from the controller to the instrument puts the instrument in the impedance measurement mode. The command PS PS causes the number of data points to be reduced to one-fourth, and the command BW clears the impedance measurement mode.

(3) In the impedance measurement mode, display data is stored over 500 memory locations beginning from address C818. The scale data is stored in a memory area beginning from address C018. Each data point is represented by an orthogonal coordinate point of (x, y), and is stored as X1, Y1, X2, Y2, X3, Y3, and so on in ascending order.

Data should be taken out in decimal form by pressing the $\boxed{\text{VIEW}}$ key. Meaningful data is between 0 and 1023. Data beyond 1023 is blanking data, which should be ignored.

To convert the outer circumference of the scale into data (xn, yn) which represents a circle with its center located at (0, 0) and a radius of 1, use the following conversion formulas:

xn = (x - 512)/500, yn = (y - 512)/500

A basic programming example using the Hewlett Packkard Model 9826 Controller is shown below. After executing this program, measurement information is plotted on the 9826 display.

```
10    GINIT
20    GRAPHICS ON
30    A=1.024
40    WINDOW -A*4/3,A*4/3,-A,A
50    OUTPUT 701;"RDC8180040 TO"
60    PEN -1
70    FOR I=1 TO 500
80    ENTER 701;X
90    ENTER 701;Y
100   DRAW (X-512)/500,(Y-512)/500
110   PEN 1
120   NEXT I
130   END
```

Figure 9-31, 32, 33 show plotting examples of Smith chart, Enlarged Smith chart, and polar coordinate, respectively.

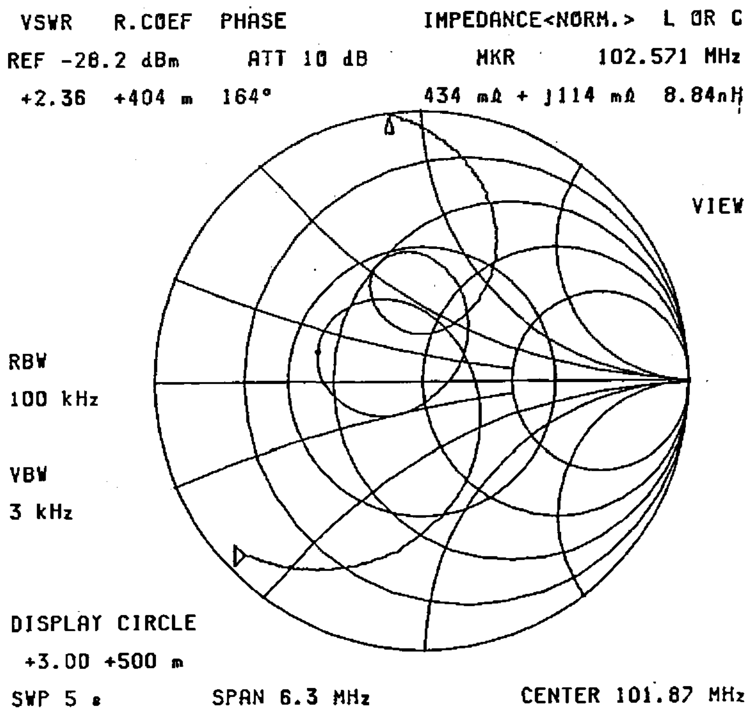


Fig. 9-31 Smith chart plotted

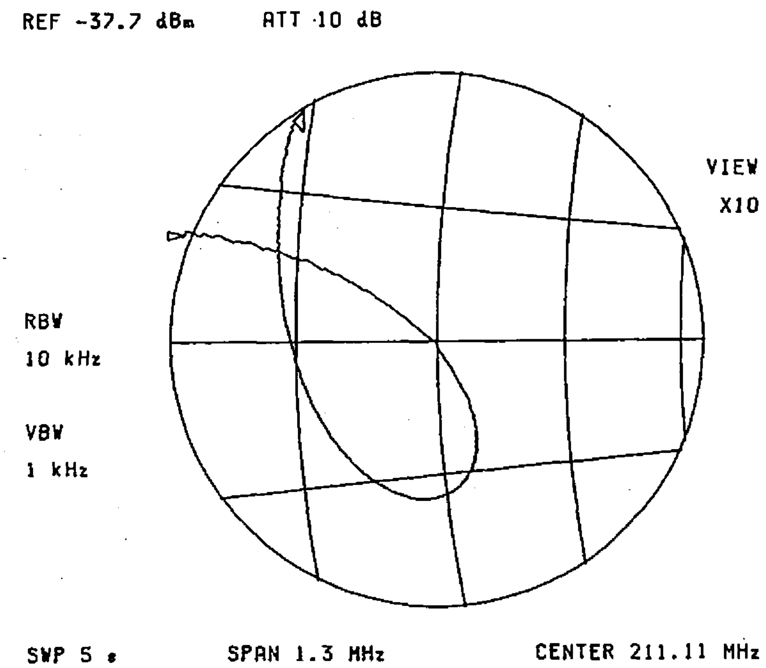


Fig. 9-32 Enlarged Smith chart plotted

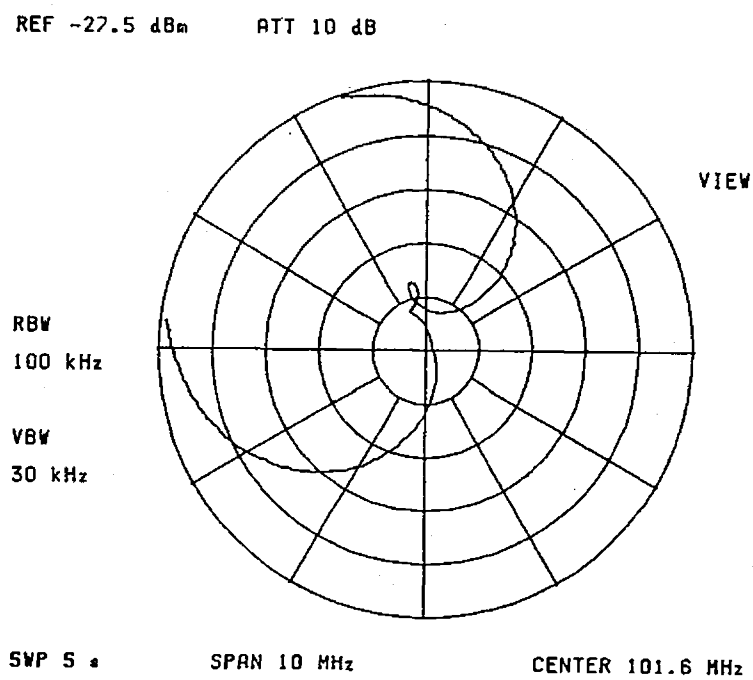


Fig. 9-33 Polar coordinate display plotted

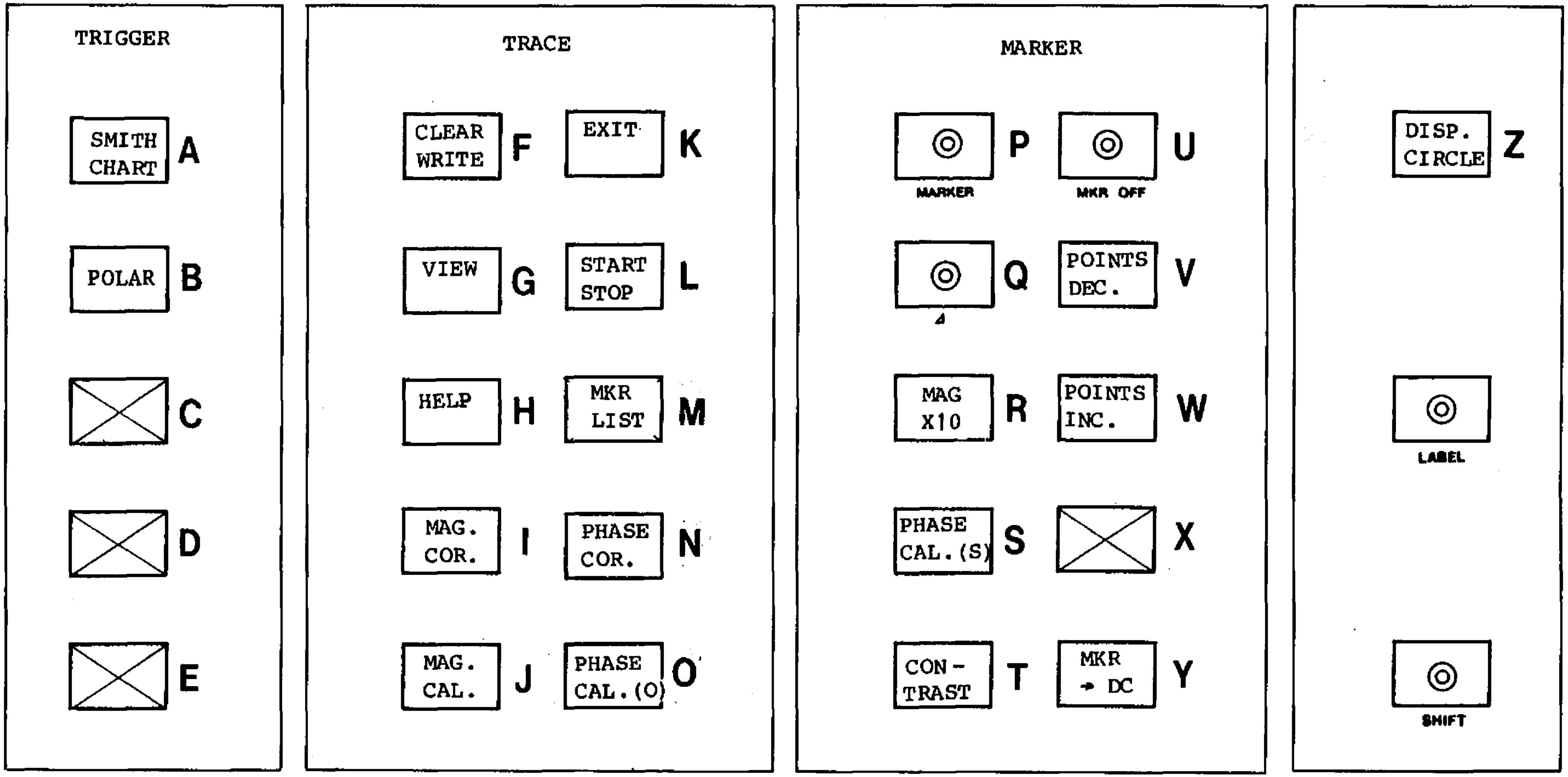


Fig. 9-34 Key functions unique to the impedance measurement mode (Keys marked ☒ are not operative. Keys marked ◎ have their original functions.)

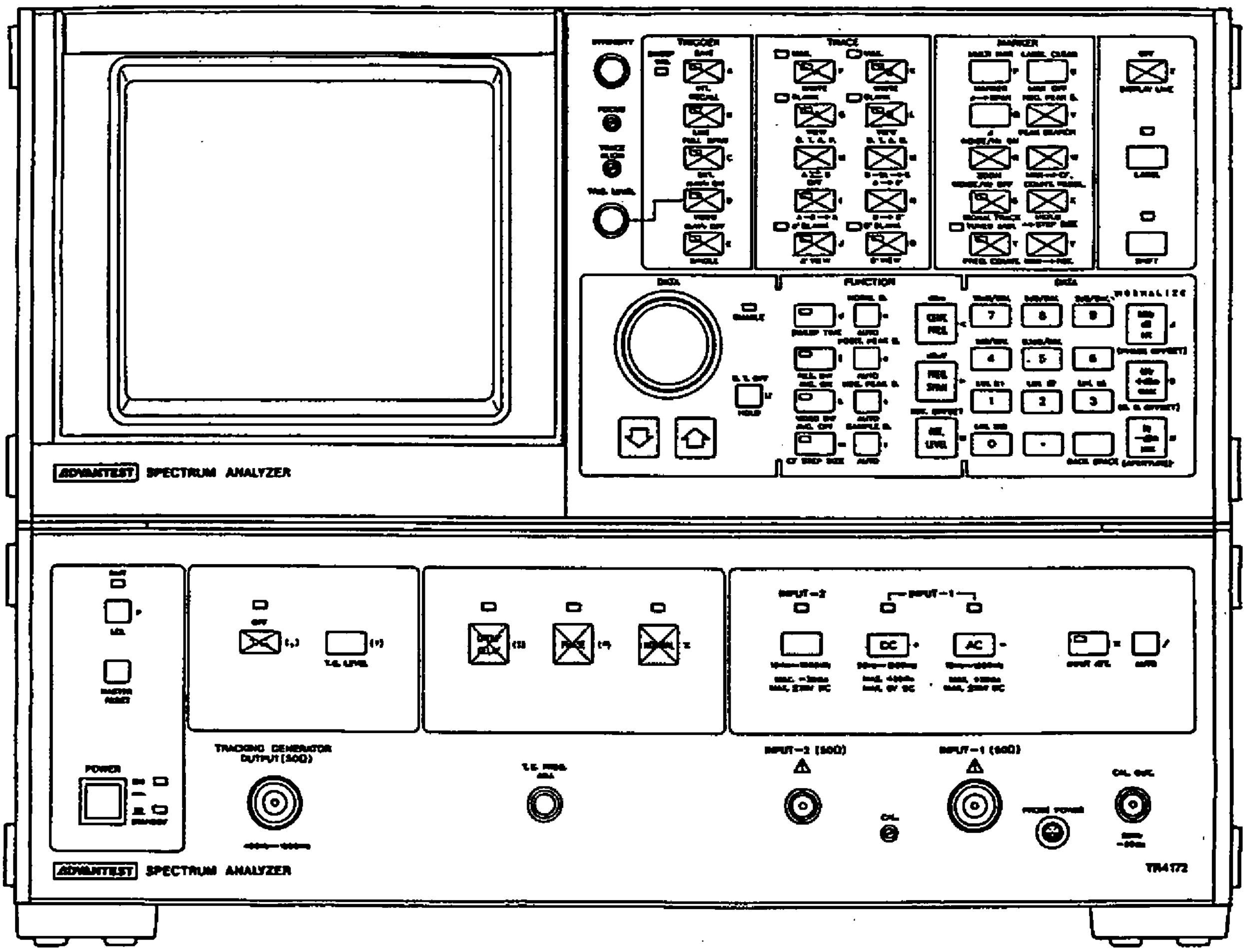


Fig. 9-35 Keys having different functions in the impedance measurement mode. (All keys other than those marked ⊠ have their original functions.)

SECTION 10

PRINCIPLES OF OPERATION

10-1. GENERAL

This section provides brief descriptions of the configuration of the TR4172 Spectrum Analyzer and its functional divisions, and some detailed explanations of the operation theories of each of these divisions. Detailed schematic diagrams are given in the back of this manual. See the Abbreviations in Section 14 and Technical Terms in Appendix for the meanings of technical terms and special parts referred to in this section.
This section is designed primarily for the reference for engineers and electronics technicians.

10-2. CONFIGURATION

The TR4172 Spectrum Analyzer is a heterodyne receiver. It converts input signal frequency into a given intermediate frequency (IF) and uses this IF signal for all subsequent signal processing, information display, and level readout.
The TR4172 contains a tracking generator (signal generator generating a frequency identical to the input signal frequency) and a frequency counter, which provides phase measurement, group-delay measurement, and micro-level signal frequency measurement capabilities.
An internal microprocessor controls all measurement condition setup, data storage, display, and display information processing. Control access or data read from an external controller can be accomplished over the GPIB.
Figure 10-1 and 10-2 show outlines of the instrument configuration. The structure of individual functional divisions will be described in 10-3 and subsequent paragraphs.
The TR4172 consists of an RF section and a DISPLAY section.
The RF section converts input signals into IF signal. It consists of a Sub-panel; YIG oscillator; Standard, RF, 1st local PLL, 3rd local, Tracking generator, Counter, and RF Power blocks; and other control boards (Attenuator I/O, YIG oscillator I/O, and 3rd local I/O boards).
The final IF output of the RF section is 3.33333 MHz.

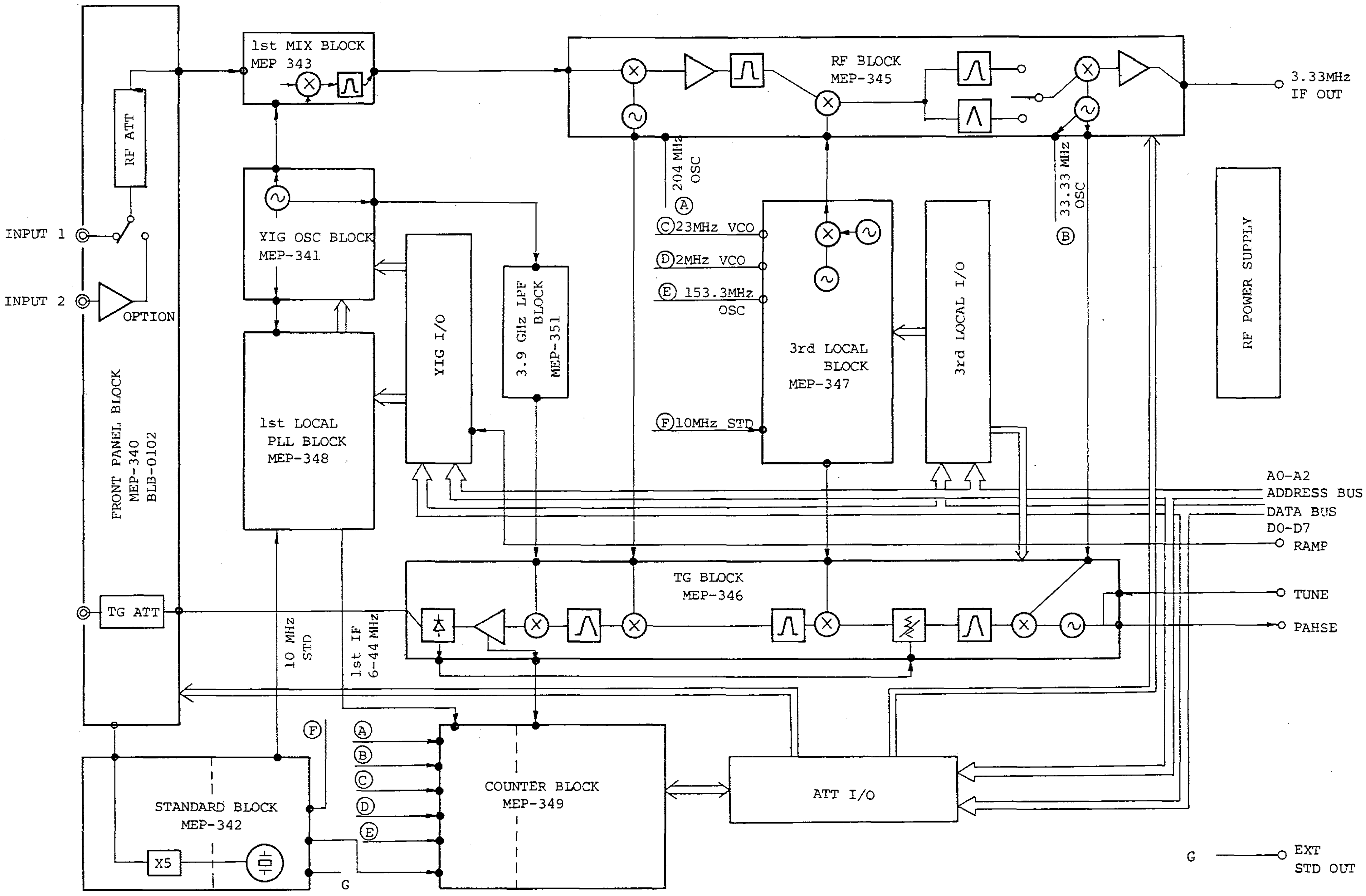


Fig. 10-1 TR4172 Block Diagram-1 RF Section

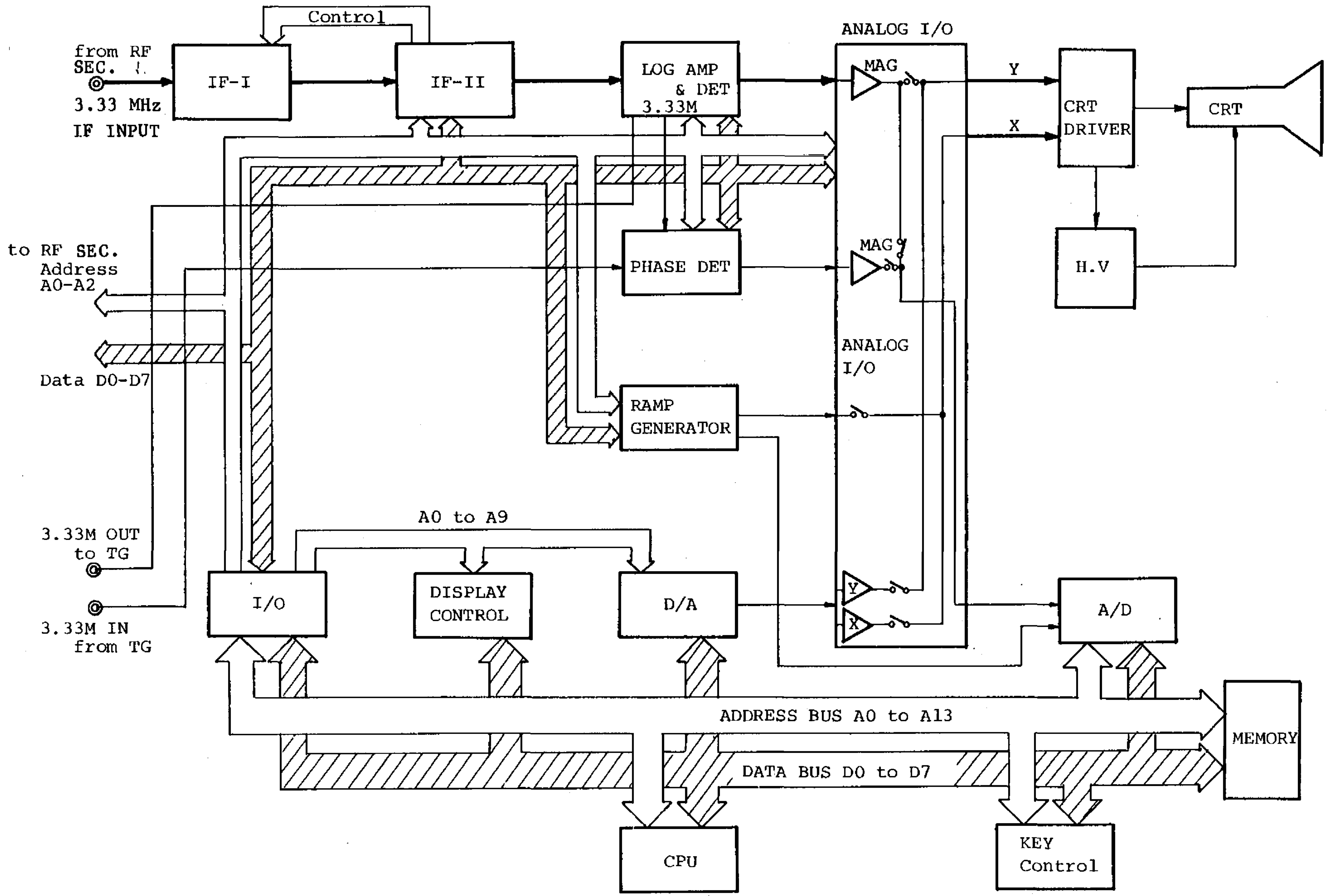


Fig. 10-2 TR4172 Block Diagram-2 Display Sect.

The display section receives the IF signal output from the RF section and performs various arithmetic and logical processing on the signal before displaying it on the CRT. It contains IF, Log amp., Phase, high voltage, CRT driver, and Display power blocks; and several processing boards, such as CPU, Memory, A-D converter, D-A converter, I/O & GP-IB, Ramp Generator, Display Control, and Analog I/O boards.
The display section breaks down the input IF signal into several components in its IF section, performs logarithmic compression on these components in the Logarithmic block, then converts the signal into DC. It then converts this DC level into the corresponding digital code, processes and stores the digitally-coded data, converts it into various forms according to selected functions, and converts it again into an analog signal before delivering it to the CRT for measurement information display.
The following paragraphs describe the functions and operations of each section.

10-3. FUNCTIONAL BLOCK OPERATIONS IN THE RF SECTION

10-3-1. Sub-Panel Block (MEP-340) (Circuit diagram No. 41)

(1) RF ATT. and DC-AC switching

A DC-AC mode selector switch and an attenuator convering an attenuation range of 0 to 50 dB are contained in the same housing.

RF ATT

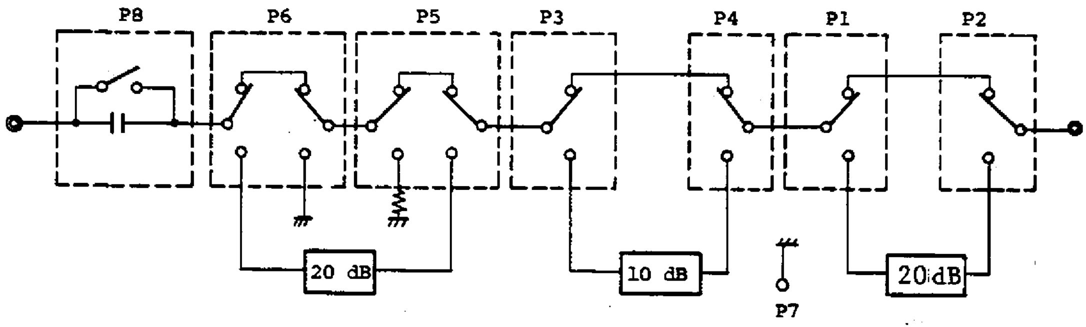


Fig. 10-3 Internal configuration of RF attenuator

Table 10-1 Control data for AC-DC switch and RF attenuator

	P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8
0dB	0	1	0	1	1	0		
10 dB	0	1	1	0	1	0		
20 dB	1	0	0	1	1	0	GND	
30 dB	1	0	1	0	1	0		
40 dB	1	0	0	1	0	1		
50 dB	1	0	1	0	0	1		
AC/DC								0/1

The control data is held by the Attenuator I/O board (BGN-010220) and is coupled to the attenuator assembly via the Attenuator Driver board (BLB-010223).

(2) TG Attenuator

The TG Attenuator has the same configuration and control requirements as the RF Attenuator. However, it does not contain P8.

(3) Preamplifier BLB-010233 (Circuit diagram No. 43)

The Preamplifier is used when Option 02 is installed in the instrument. It has a gain of +25 dB over a frequency range from 10 MHz to 1 GHz for micro-level signal measurement. The power to the Preamplifier is activated only when the front INPUT-2 key is activated.

(4) Attenuator Driver (BLB-010223) (Circuit diagram No. 42)

This board provides control data to the RF attenuator, AC-DC selector switch, TG attenuator, and preamplifier power supply. All data lines from this board are connected to the ATT I/O board, with the exception of the Power On Data line.

10-3-2. 1st Mixer Block (MEP-343) (Circuit diagram No. 50)

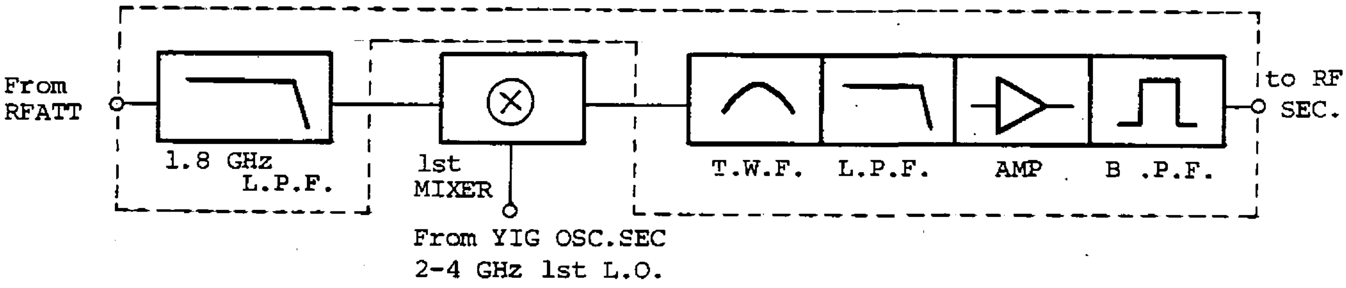


Fig. 10-4 1st Mixer block diagram

The 1st mixer block contains a first mixer and input/output interface.

(1) 1.8 GHz low-pass filter (LPF)
The 1.8 GHz LPF consists of balanced microstrip lines which constitute a 15-stage Chebyshev filter array.

(2) First mixer BTB-010136 (Circuit diagram No. 51)
Double-balance mixer whose characteristics significantly affect the frequency response flatness, higher harmonic distortion, and gain compression level. The diode bridge uses eight Schottky diodes.

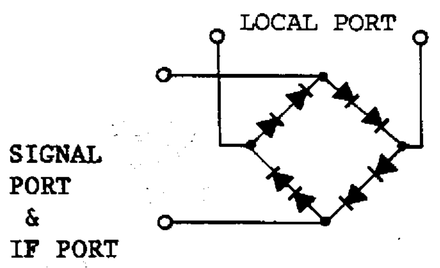


Fig. 10-5 First mixer

Input signal frequency ranges from 50 Hz to 1800 MHz, while local oscillator (first local oscillator) frequency ranges from 2.046 to 3.846 GHz (+20 dBm or more), and the resulting intermediate frequency is 2.046 GHz.

(3) Interface

The interface amplifies only the 2.046 GHz component out of the IF signal output of the first mixer to prevent spurious interference by other frequencies. It consists of a band-pass filter and other components (see Figure 10-4), and has a minimum gain of 0 dB.

10-3-3. YIG Oscillator Block (MEP-341) (Circuit diagram No. 44)

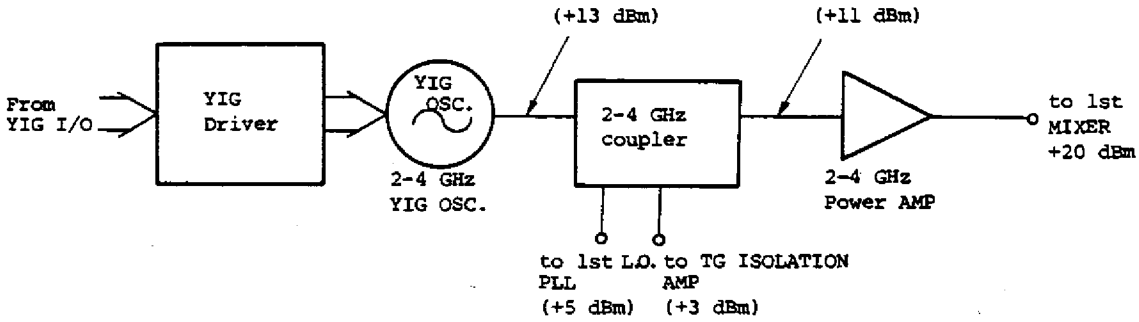


Fig. 10-6 YIG Oscillator block diagram

(1) YIG Oscillator

The first local oscillator in the TR4172 is a YIG oscillator covering an output frequency range from 2 to 4 GHz. The YIG oscillator is essentially a sweep oscillator characterized by output purity, low hysterisis, and high linearity. The output level at its output terminal is more than +13 dBm over the entire frequency range.

(2) 2 to 4 GHz coupler

This coupler is used to branch the YIG OSC output into the TG and first local phase lock loop blocks. Each branching path has coupling losses of -10 dB and -8 dB respectively, and the resulting output levels at the coupler's outputs are +3 dBm and +5 dBm respectively. The output to the first mixer has a level of +11 dBm.

(3) 2 to 4 GHz power amplifier

The power amplifier amplifies the output of the coupler to +20 dBm or more, the level required for the local oscillator input to the first mixer. The maximum supply voltage to the power amplifier is +10 Vdc.

(4) YIG OSCILLATOR DRIVER BLC-010224 (Circuit diagram No. 45)

The YIG oscillator contains main and FM drive coils. Its output frequency is controlled by driving these coils according to the data furnished from the YIG I/O board (BGN-010219). The controllable ranges for each coil are as follows:

Main coil Span > 10 MHz: Sweep, tune
Span < 10 MHz: Fixed

FM coil 10 MHz ≥ Span > 500 kHz: Sweep, tune
Span ≤ 500 kHz: Tune fixed, PLL voltage

These ranges are controlled by the CPU via the YIG I/O board's control line.

10-3-4. Standard Block (MEP-342) (Circuit diagram No. 46)

(1) Timebase BLB-010134 (Circuit diagram No. 47)

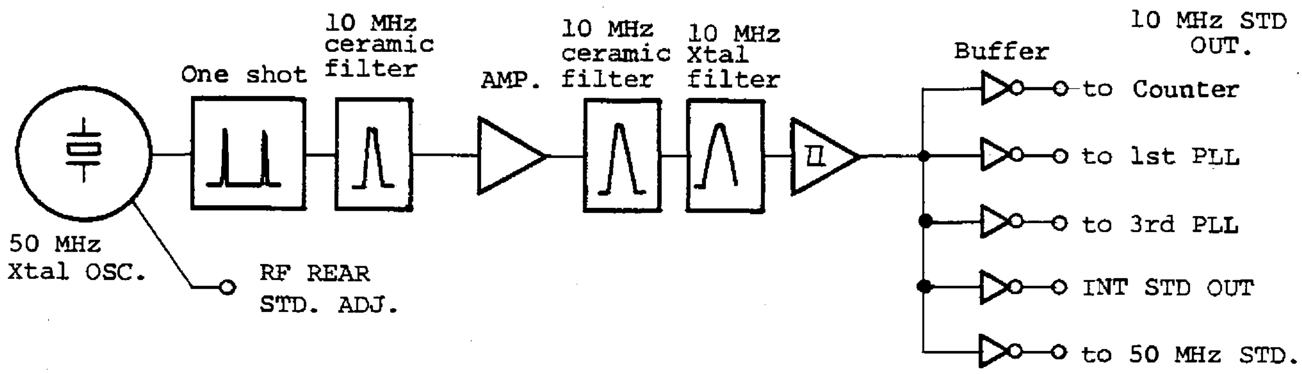


Fig. 10-7 Timebase generator block diagram

The timebase generator generates a 5 MHz timebase signal (TTL conpatible) by its quartz-controlled oscillator, whose output is first waveform shaped, then converted into a 10 MHz signal by ceramic filters and amplifier. The output of the second ceramic filter goes through a 10 MHz crystal filter to reject noise components before being delivered to each block in TTL compatible level.

The output of the timebase oscillator can be directly tested at the INT. STD OUTPUT (J4) terminal on the rear of the instrument.

(2) 50 MHz Standard BLB-010135 (Circuit diagram No. 48)

A 50 MHz calibration signal for level and frequency reference is generated by 50 MHz Standard and output to the CAL. OUT. connector on the front panel. Its level is -20 dBm ±0.3 dB, and its frequency stability depends on that of the timebase master crystal oscillator.

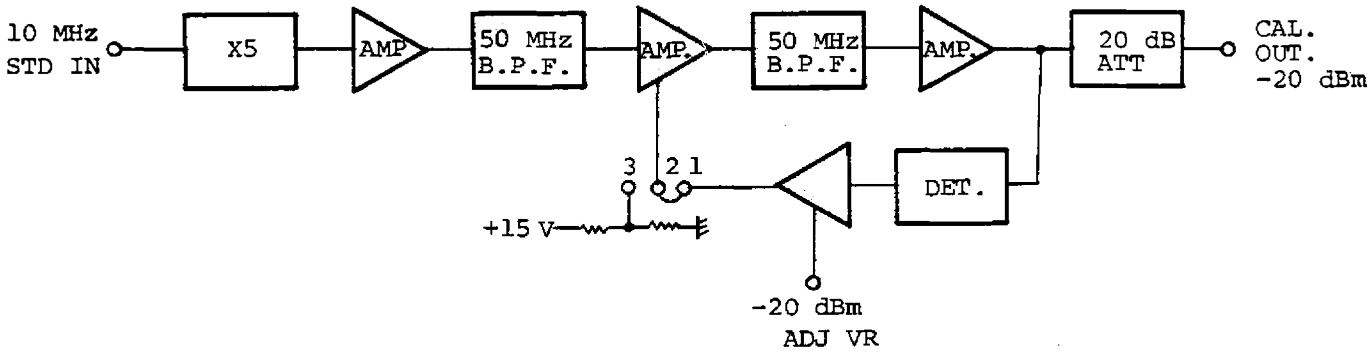


Fig. 10-8 50 MHz Standard

The generator multiplies the 10 MHz TTL input from the timebase oscillator by five into 50 MHz, and then rejects unnecessary frequency components by the following band-pass filters. To stabilize the output level, an auto level control (ALC) loop is formed around the second and third amplifiers.

10-3-5. RF Block MEP-345 (Circuit diagram No. 52)

The RF block consists of a second local oscillator, fourth local oscillator, second mixer, third mixer, fourth mixer, IF gain control amplifier, and so forth. It converts down the 2.05 GHz IF signal form the first mixer block and outputs the final IF signal of 3.33 MHz. Figure 10-9 shows the block diagram of the RF block.

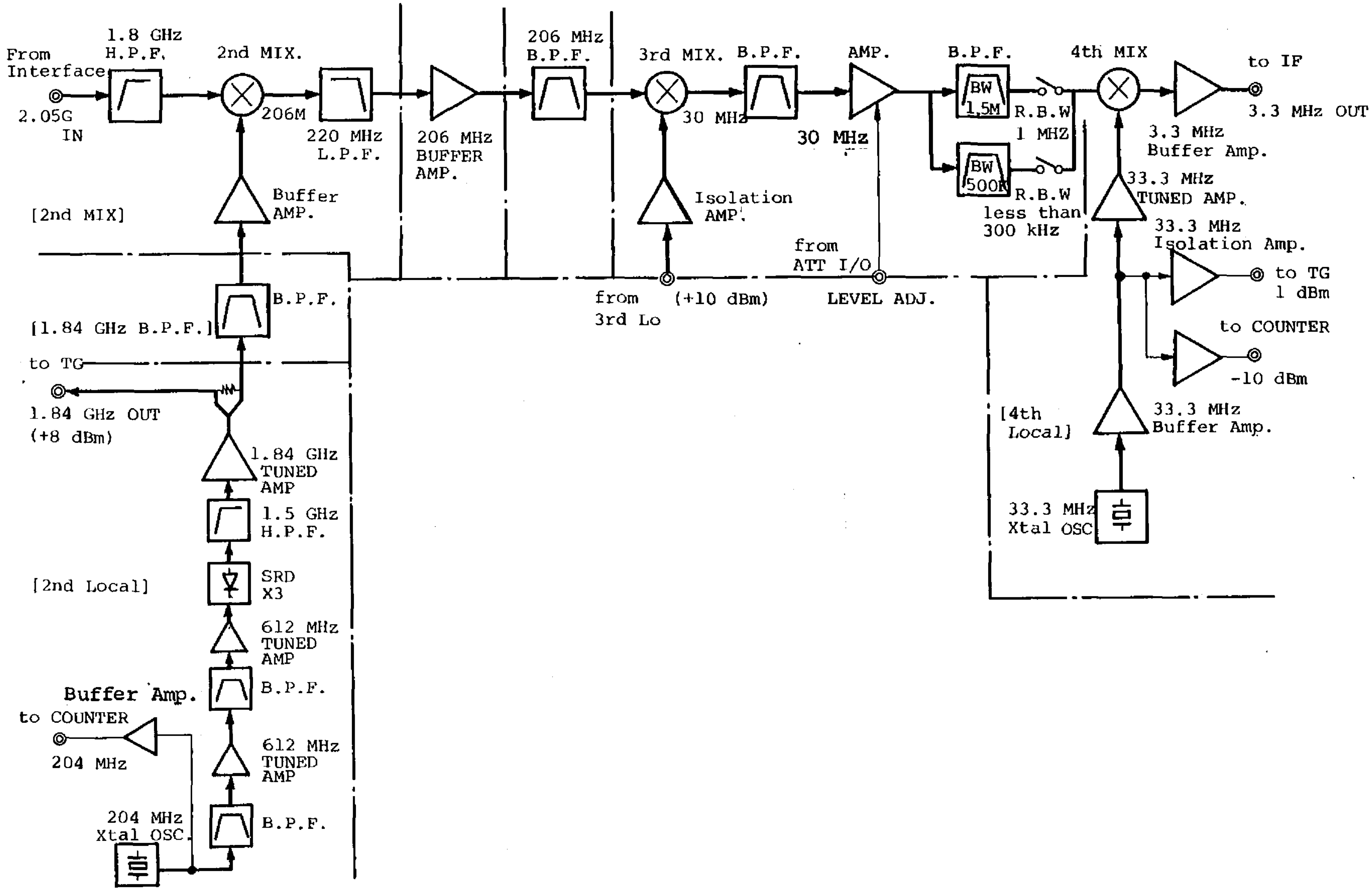


Fig. 10-9 Block diagram of the RF block

(1) 2nd local oscillator

The 2nd local oscillator provides an output frequency of 1.84 GHz, which is obtained by multiplying a 204.4 MHz output of the quartz-controlled oscillator by nine. It furnishes its output to the second mixer and TG 2nd local oscillator.

The quartz oscillator output of 204.4 MHz is first multiplied by 3.

The output of the multiplier goes through a buffer amplifier and a band-pass filter (BPF) to boost the signal level to more than +10 dBm. It is then applied to a step recovery diode to generate the 1.84 GHz frequency component. The output of the diode goes through a high-pass filter (HPF) and a 1.84 GHz tuned amplifier before it is branched into the two paths to the second mixer and TG. The output to the second mixer goes through a 1.84 GHz BPF and 1.84 GHz tuned-amplifier before being coupled to the mixer. Part of the 204 MHz quartz oscillator output is coupled to the counter block via a buffer amplifier. This output is counted by the CPU and used for center frequency setup or 2nd local oscillator maintenance.

(2) Second mixer

The second mixer is the single balanced type. It mixes the first IF signal of 2.046 GHz (from the first mixer block) with the second local oscillator output of 1.84 GHz to create the second IF signal of 206 MHz. This second IF signal is output via a 220 MHz LPF.

(3) Second IF tuned amplifier and BPF

The second IF tuned amplifier compensates for losses in the second mixer and 206 MHz BPF of improve signal-to-noise ratio. It has a gain of 14 dB, and deals with the highest signal in the TR4172's signal paths. The 206 MHz BPF is a 4-stage herical bandpass filter.

(4) Third mixer

The third mixer mixes the second IF signal of 206 MHz with the third local oscillator output to create the third IF signal of 30 MHz. It is a high-level, double-balanced mixer using diode resistance.

(5) Level correction amplifier

Level correction is accomplished by the CAL screwdriver control on the front panel and the sweep signal to compensate to change the gain of this amplifier.

(6) 30 MHz BPF switching circuit

This circuit switches the 30 MHz BPF signal paths between RBW 1 MHz, RBW 300 kHz or below to eliminate unnecessary frequency components.

(7) Fourth local oscillator and 33.33 MHz quartz-controlled oscillator

The fourth local oscillator is a colpitts type quartz-controlled oscillator. The output is branched via a buffer amplifier into three paths to the 4th local oscillator, TG, and counter. The output to the 4th local oscillator is further amplified for high-level mixing before being coupled to the fourth mixer.

(8) Fourth mixer

The fourth mixer mixes the third IF signal of 30 MHz with the fourth local oscillator output of 33.3 MHz to provide the final IF signal of 3.33 MHz.

Figure 10-10 shows RF Section level diagram.

10-3-6. 1st Local PLL Block (MEP-348) (Circuit diagram No. 64)

The YIG oscillator output may be affected by noise interference when the frequency span is narrowed down. The first local oscillator PLL block stabilizes this YIG oscillator (first local OSC) output against noise interference by means of the PLL technique. Figure 10-11 shows the block diagram. The PLL block is activated when a frequency span of 500 kHz or less is selected.

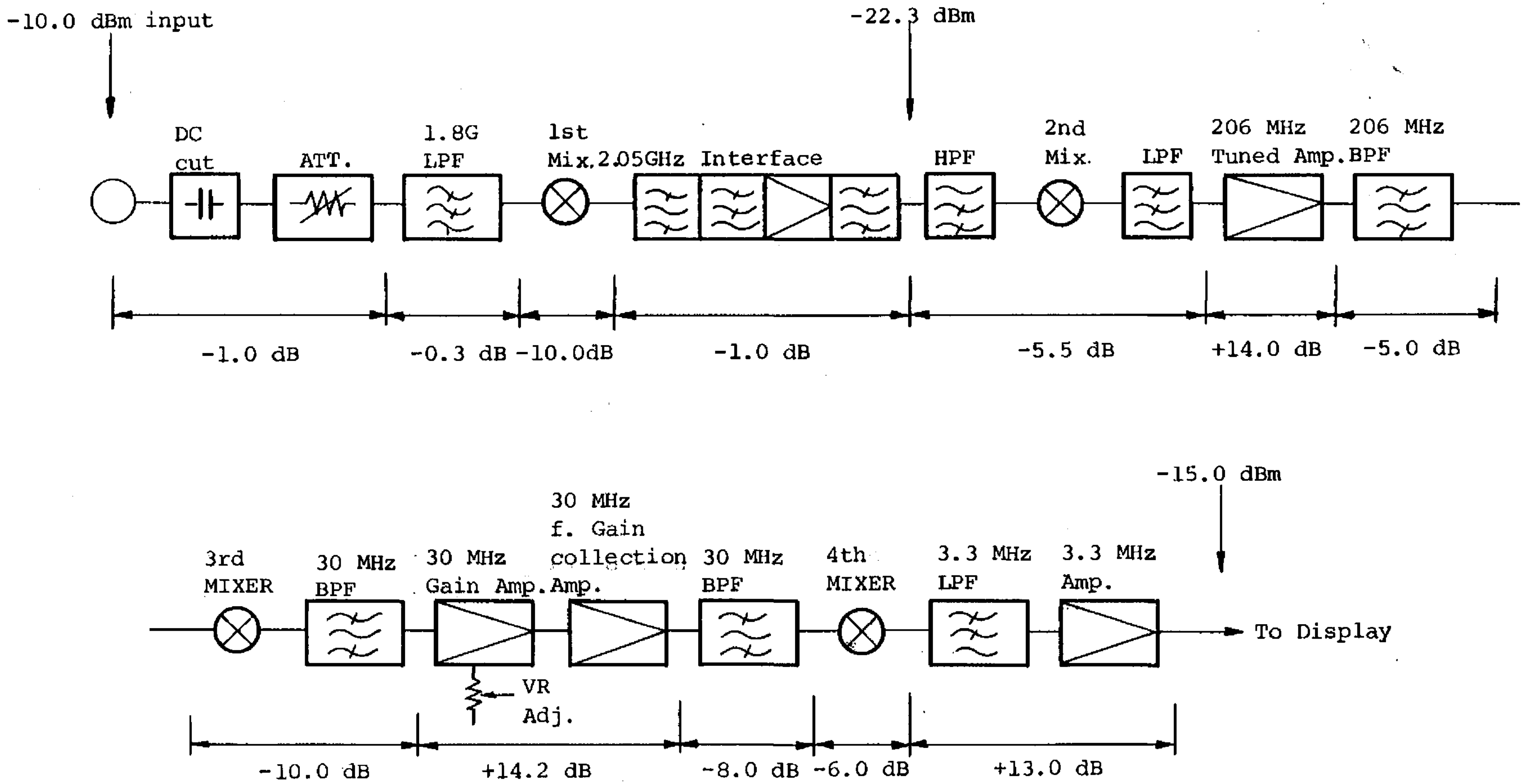


Fig. 10-10 RF section level diagram

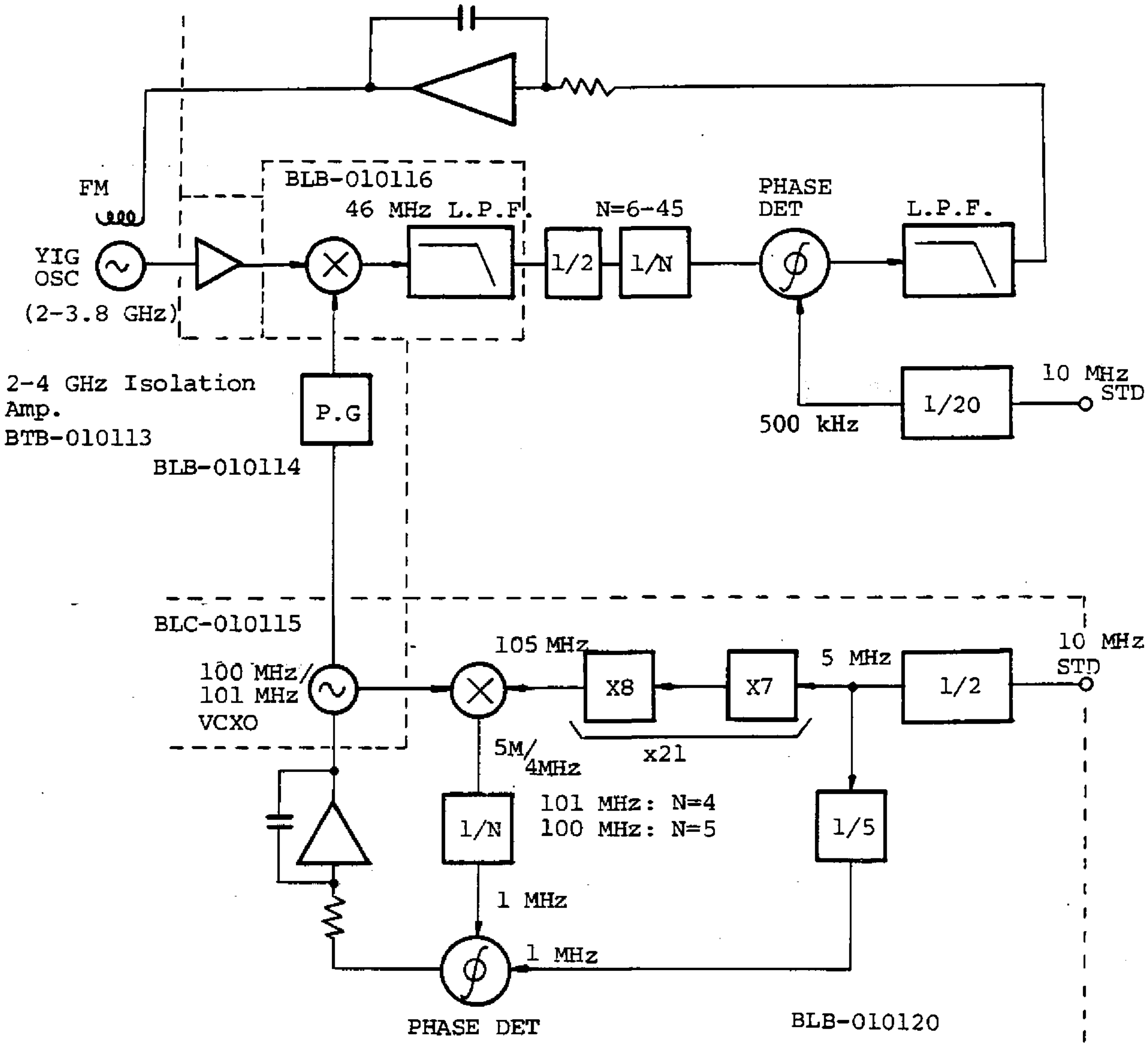


Fig. 10-11 First Local PLL block diagram

(1) **Isolation amplifier** BTB-010113x01/02 (Circuit diagram No. 65)

Buffer amplifier for the first local signal of 2-4 GHz furnished from the YIG oscillator block. It consists of a three-stage transistor amplifier and three 3-dB attenuators to provide electrical isolation between the 100/101 MHz signal and the YIG section.

(2) 100/101 MHz oscillator BLC-010115 (Circuit diagram No. 67)
The phase locked loop (PLL) performs phase comparison between the output of a given oscillator and that of a reference oscillator to "lock" the frequency of the former oscillator to that of the reference oscillator. The first PLL block in the TR4172 uses two quartz-controlled oscillators of 100 MHz and 101 MHz each, for the reference oscillators. One of the two reference oscillators is selected depending on center frequency setting. Figure 10-12 shows the selection VS center frequency. The two oscillators are necessary to eliminate the dead zone of the IF signal output between 2 and 4 GHz and to permit formation of phase locked loop at any frequency.
The outputs of these crystal oscillators are input to the 100/101 MHz PLL networks (described later) to construct another phase locked loop which reference the 10 MHz time base frequency. The outputs of the two oscillators are amplified to more than +20 dBm and coupled to the first PLL pulse generator.

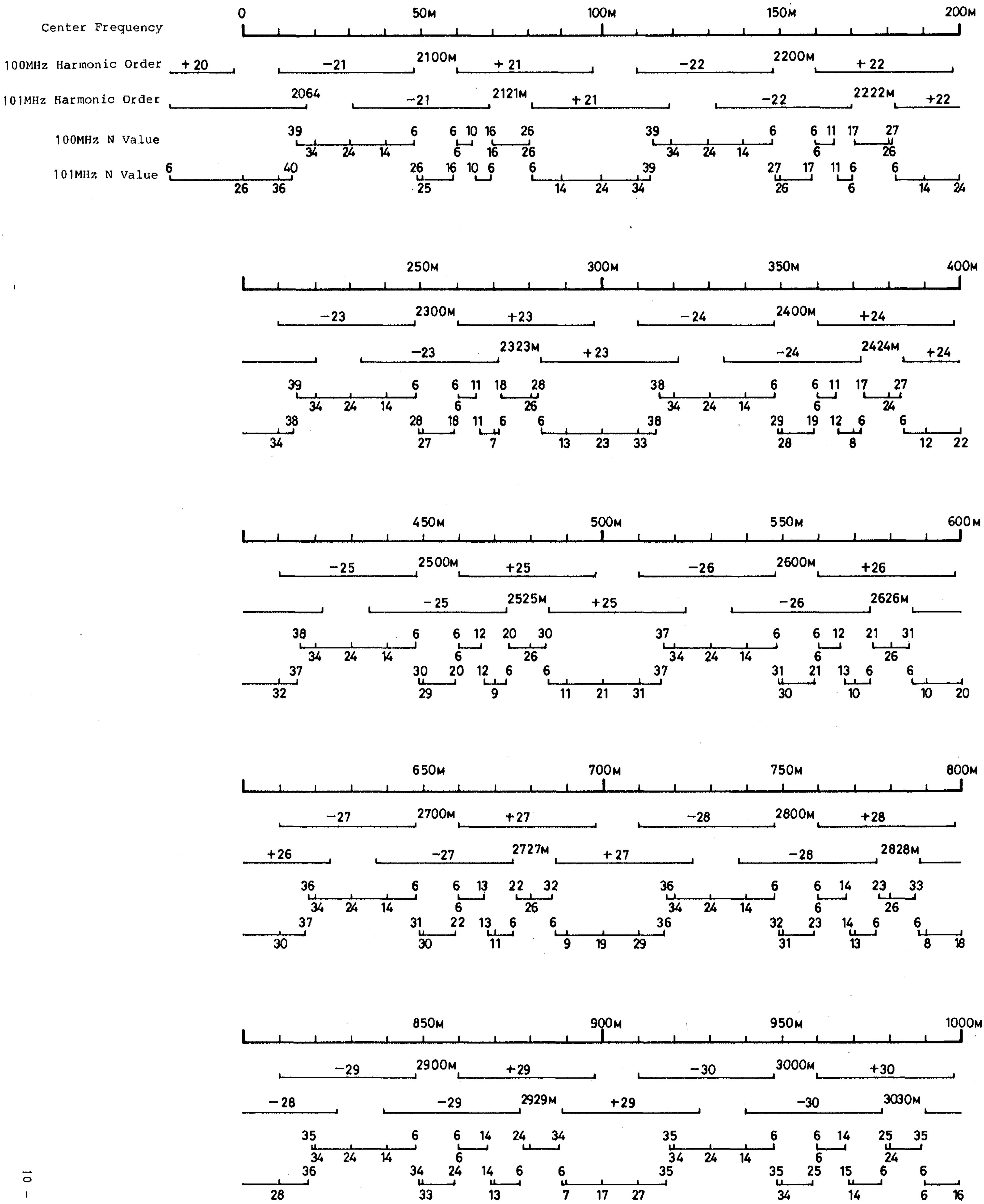


Fig. 10-12 TR4172 LOCK N value

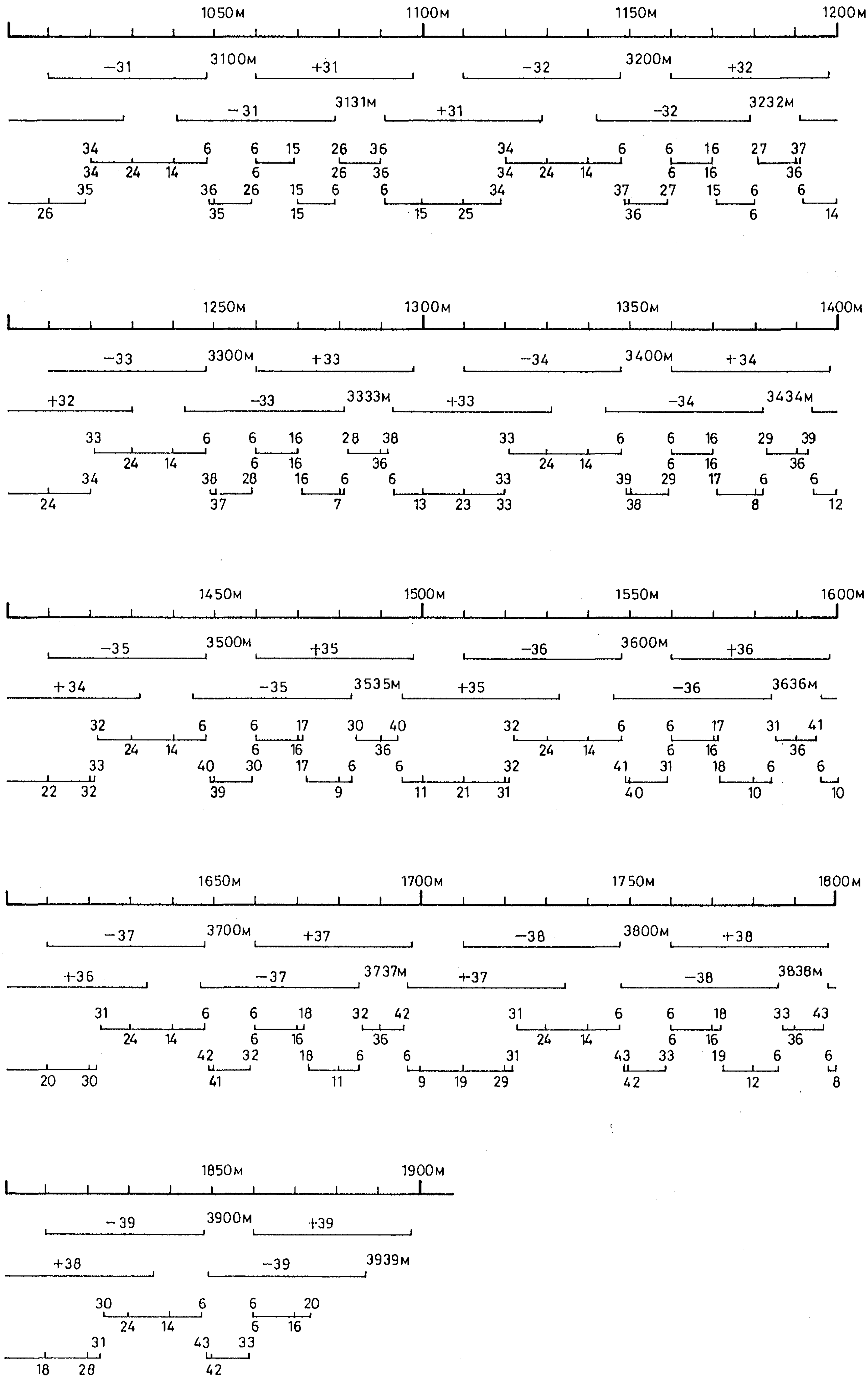


Fig. 10-12 TR4172 LOCK N value (Cont'd)

Comments on Figure 10-12

1) "M" in the figure means "MHz".
2) N value corresponding to center frequency, which is indicated by 10 MHz interval in this figure, is identified with the numerical characters marked at lower side of the 100 MHz N or 101 MHz N value scale.

   Therefore, 101 MHz N value is 26 at 0 MHz center frequency, and
   100 MHz N value is 6 at 260 MHz center frequency,
   for example.
3) N value counts up/down one by one as center frequency varies by 1 MHz.

   Therefore, N value at 26 MHz center frequency is determined;
   N = 34 - 6 = 28 , for example.
   (c.f.: N = 34 at 20 MHz center frequency, and
   N = 24 at 30 MHz center frequency.)

(3) 100/101 MHz PLL BLB-010120 (Circuit diagram No. 72)

As mentioned in paragraph (2), PLL networks are provided for the 100/101 MHz quartz-controlled oscillators using the 10 MHz time base frequency as a reference. The 10 MHz time base goes through a 1/2 divider and then x7 and x3 multiplier to generate a 105 MHz signal. This 105 MHz is mixed with the 100/101 MHz to generate 5 MHz/4 MHz IF signals. These IF signals are then divided by 5 and 4 respectively, and are compared, in terms of phase, with 1/10 (1 MHz) the time base frequency. The comparison result couples to an LPF to create control voltages. These control voltages are fed back to the 100/101 MHz oscillators to form PLL networks.

(4) 2 - 4 GHz PULSE GENERATOR BTB-010114 (Circuit diagram No. 66)

The 100/101 MHz oscillator outputs are applied to step recovery diodes to generate a comb signal of 2 to 4 GHz for the 100/101 MHz signals. The 2 to 4 GHz comb signal has a minimum level of -25 dBm.

(5) 1st LOCAL MIXER BLB-010116 (Circuit diagram No. 68)

Mixes the 2 to 4 GHz first local oscillator output from the isolation amplifier with the 100/101 MHz COM signal to generate a 6 to 44 MHz IF signal. This IF signal is taken out through a 45 MHz LPF.

(6) Digital phase detector BLB-010118 (Circuit diagram No. 70)

The IF signal output (6 to 44 MHz) of the first PLL mixer is converted to TTL level by an isolation amplifier and Schmitt trigger circuit. It is then divided by 2 and coupled to a dividing-by-N divider where it is frequency divided according to the dividing data furnished by the CPU. The signal is then assigned a + or - sign and coupled to the phase detector input. Since the input signal was divided by two before being coupled to the 1/N divider, the 1st local OSC output can be phase locked at 1MHz intervals if the reference signal is also divided by 2, that is, to 500 kHz.

The + or - sign determines to which input (of the two phase detector inputs) the reference signal is to be applied according to the information indicating whether the setup center frequency is higher or lower than the 100 and 101 MHz comb signal since the same IF signal may be output at two different center frequency settings. (See Figure 10-13.) The phase detector output is coupled to a PLL filter via an active LPF.

(7) PLL filter BLB-010119 (Circuit diagram No. 71)
The output of the digital phase detector is applied to the FM port of the YIG driver via this PLL filter to form a PLL loop.

10-3-7. Third Local Block (MEP-347)

Figure 10-14 shows the configuration of the third local block oscillator. This block contains a sweep oscillator which is activated at a frequency span below 500 kHz. It consists of five boards: 23 MHz VCO, 2 MHz VCO, 39 MHz mixer, 176 MHz mixer, and third local PLL. The third local block is controlled by the control signal from the 3rd Local Oscillator I/O.

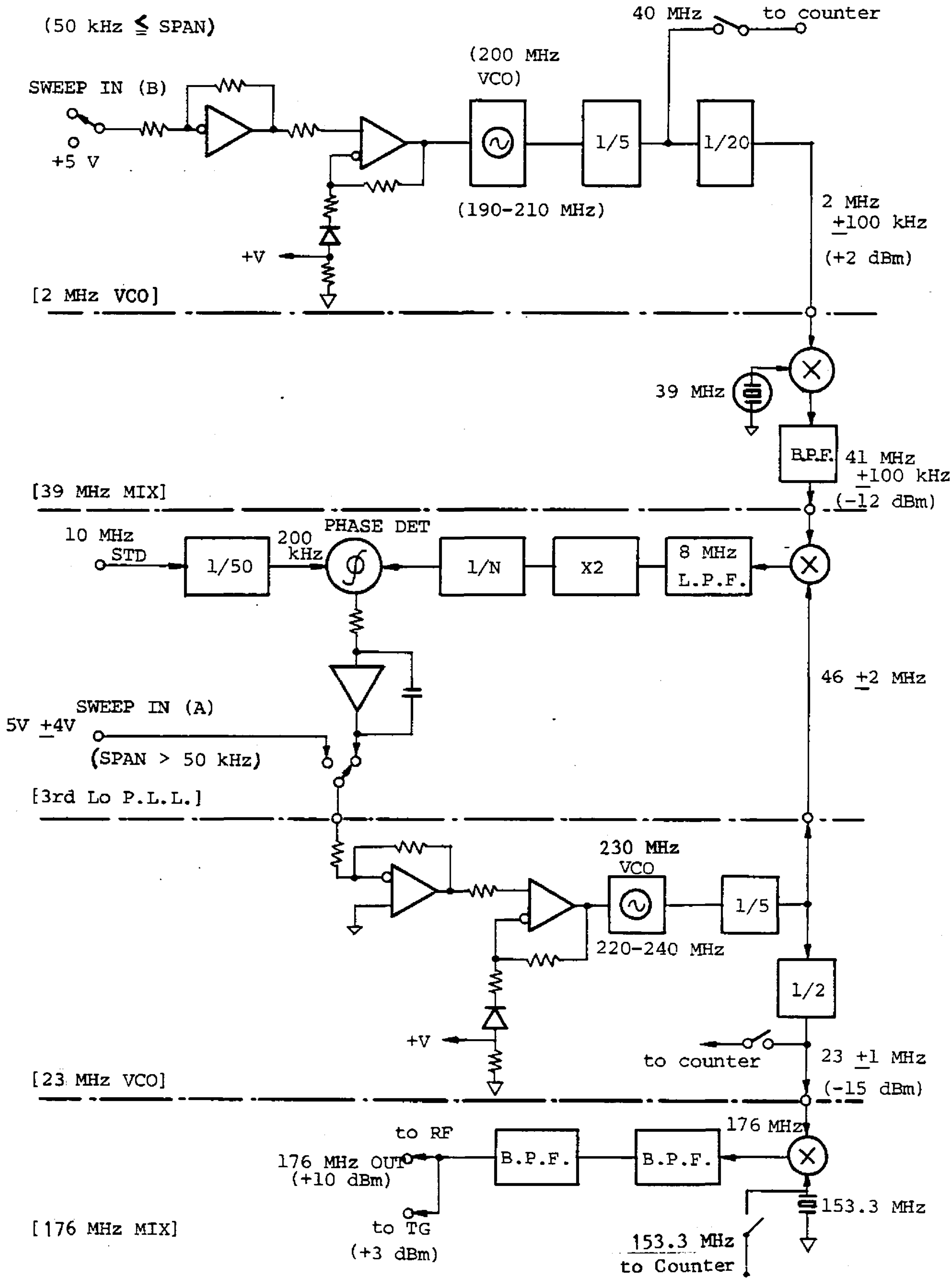


Fig. 10-13 Third local OSC block (MEP-347)

(1) 23 MHz VCO BLC-010101 (Circuit diagram No. 61)

A VCO output of 230 MHz is divided by 10 to create the output of this board and to improve phase noise characteristics. A cable with good vibration resistance and high Q is used for oscillator's inductance, while a varicap diode with good linearity is used for capacitance. The VCO control voltage is furnished from the third local I/O block (BGN-010221), and is coupled to the VCO diode via a lineanarizer. The VCO generates a frequency between 23 MHz $\pm$1 MHz by accepting a control voltage from 1 - 9 V.

The output of the VCO is divided by 5 and then 2 into 23 MHz, which is then coupled to the 150 MHz mixer (to be described later) via an LPF. Part of the VCO output is coupled to the counter block via a switch.

When frequency span of 50 kHz or below is selected, the VCO outputs a 46 MHz signal (after only divided by 5) which is used to form a PLL loop with the 2 MHz VCO (to be described in the following).

(2) 2 MHz VCO BLC-010102 (Circuit diagram No. 62)

The 2 MHz VCO has the same oscillator configuration as the 23 MHz VCO, with the exception that the oscillator of the former VCO oscillates 200 MHz. The oscillator output is divided by 5 and then 20 into 2 MHz, coupled to the 39 MHz mixer via an LPF, forming a PLL loop with the 23 MHz VCO. The output of the 1/5 divider also goes to the counter block. When a frequency span of 10 kHz, or below is selected, a capacitor is added to the drive voltage line to eliminate drive voltage noise.

The 2 MHz OSC oscillates a frequency between 2 MHz $\pm$100 kHz by accepting a control voltage from 1 to 9 V.

(3) 39 MHz mixer BLC-010100 (Circuit diagram No. 60)

Mixes the 39 MHz crystal oscillator output with the 2 MHz VCO output to create a 41 MHz signal, which is output via a BPF.

(4) Third local PLL BLC-010103 (Circuit diagram No. 63)
The third local PLL mixes the 46 MHz output of the 23 MHz VCO with the 41 MHz mixer output (described just above) to generate a 5 MHz IF signal. This IF signal is doubled into 10 MHz and then coupled to a 1/N divider. The output of the divider is phase-compared with a 200 kHz reference signal (obtained by dividing-by-50 the 10 MHz time base signal). The comparison result goes through an LPF, then couples to the control input of the 23 MHz VCO. If, at this time, the output of the 2 MHz VCO is swept over, the 23 MHz VCO also sweeps while maintaining phase lock. This sweep is effective at a frequency span of 50 kHz or below.

(5) 176 MHz Mixer BLC-010099 (Circuit diagram No. 59)
Mixes a quartz OSC output of 153.333 MHz with the 23 MHz VCO output to create the final 176 MHz ±1 MHz output of the third local OSC.
The output is coupled to the RF and TG blocks after amplified and passing through a BPF. The output of the 153.333 MHz OSC output is also applied to the counter block.

10-3-8. Tracking Generator Block (MEP-346) (Circuit diagram No. 54)

In the tracking generator, the outputs of the four internal local oscillators are beaded up in the direction reverse to the spectrum analyzer configuration and are swept over the set up frequency span on both sides of the center frequency. The output of the tracking generator covers a frequency range between 400 kHz and 1.8 GHz. To obtain a level deviation of less than ±0.7 dB p-p, it uses an ALC loop.
Figure 10-14 shows the configuration of the tracking generator block.

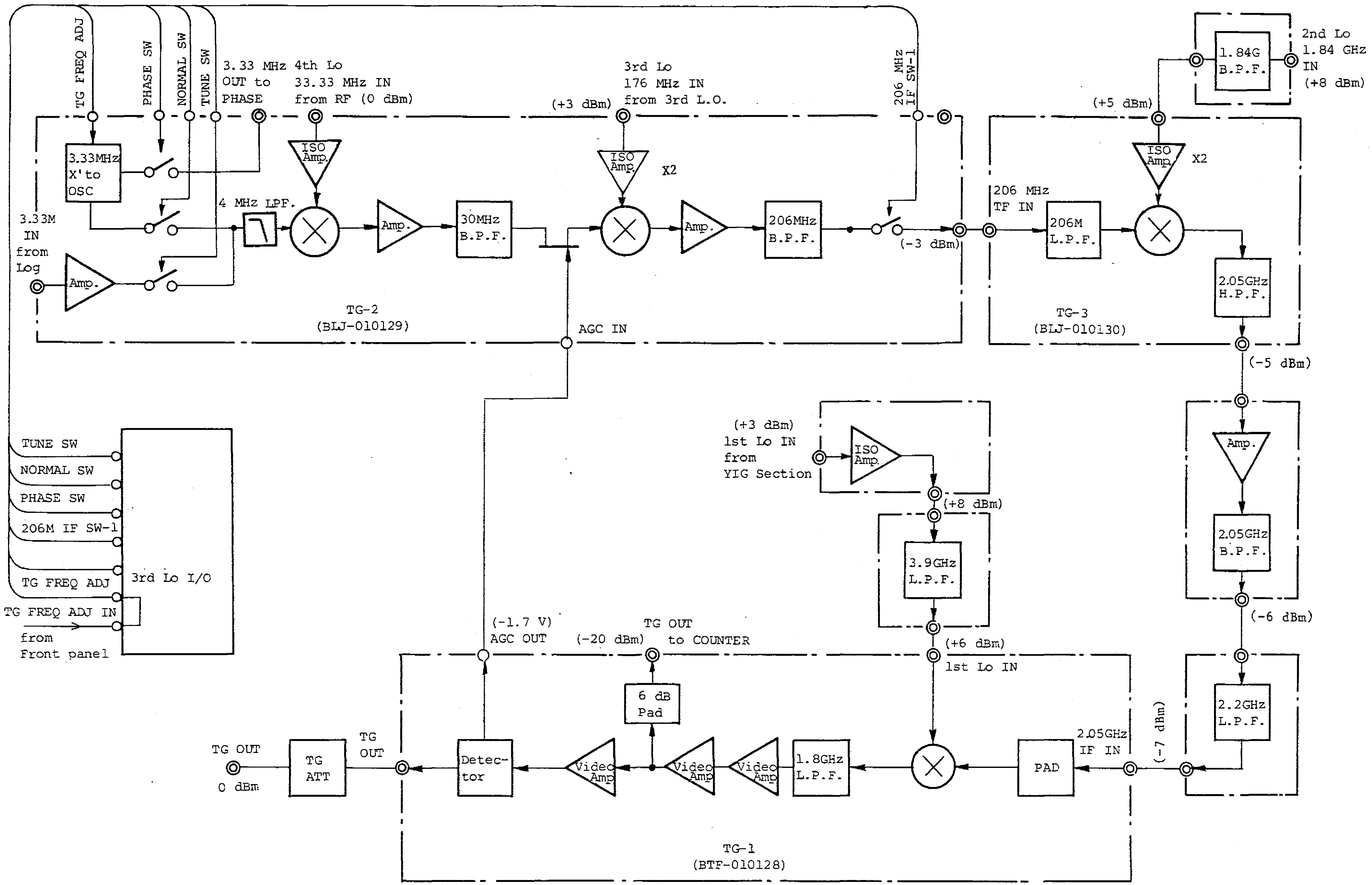


Fig. 10-14 Tracking generator block

(1) Tracking generator 2 BLJ-010129 (Circuit diagram No. 56)

The tracking generator contains a 3.333 MHz VCXO. When the RBW is narrowed down with the front T.G. FREQ. ADJ. control, the resulting tracking error is corrected by this block. For phase measurement, the 3.33 MHz output of this VCXO is used as one of the reference frequencies.

In the Normal mode, the output of the 3.33 MHz oscillator goes through an LPF and is then mixed with the fourth local OSC output coming from the RF block to create the TG 1st IF signal of 30 MHz. This IF signal goes through an amplifier and BPF, then couples to the following mixer via an FET attenuator for ALC.

The 30 MHz IF band-pass filter must have a pass bandwidth of approximately 2 MHz, since the operation level during tune amplifier operation is +15 dB higher than the noise level at an RBW of 1 MHz. The ALC control voltage is furnished from the Tracking Generator 1.

The 176 MHz output of the third local oscillator is coupled to the TG second mixer via an isolation amplifier and is converted into the 2nd IF signal of 206 MHz. This IF signal is coupled to the Tracking Generator 3 via a BPF.

(2) Tracking Generator 3 BTB-010130 (Circuit diagram No. 57)

The 206 MHz TG second IF signal furnished from Tracking Generator 2 is coupled to the TG third mixer (via an LPF), where it is mixed with the 2nd local oscillator output of 1.84 GHz furnished from the RF block via a BPF and isolation amplifier, to create the third IF signal of 2.046 GHz.

(3) 2.046 GHz isolation amplifier and BPF

The 2.046 GHz IF signal is output to Tracking Generator 1 via a 2.046 GHz tuned amplifier, BPF, and 2.2 GHz LPF. The tuned amplifier, BPF, and LPF are contained in a hybrid module.

(4) Tracking Generator 1 BTF-010128 (Circuit diagram No. 55)

The third TG IF signal of 2.046 GHz furnished from the above BPF is coupled to the TG final 4th mixer, where it is mixed with the first local OSC output of 2 - 4 GHz coming from the 3.9 GHz LPF block, to create the final TG output of 400 kHz to 1.8 GHz. This output is amplified by a three-stage video amplifier after passing through a 1.8 GHz LPF. The output to the counter is taken out from the middle of this video amplifier via a distributor.

The output level of the video amplifier is detected by a level detector and fed back to the FET attenuator in Tracking Generator 2 to form an ALC loop. The output of the tracking generator 1 is fixed at 0 dBm, and is coupled to the front panel connector via a TG attenuator.

10-3-9. 3.9 GHz LPF Block (MEP-351) (Circuit diagram No. 76)

The 2-4 GHz first local oscillator output for TG is furnished from a coupler in the YIG block to this 3.9 GHz LPF block. It then goes through a 2-4 GHz isolation amplifier and a 3.9 GHz LPF (which rejects second and higher harmonics) before output to the TG-1 block.

10-3-10. Counter Block (MEP-349) (Circuit diagram No. 73)

The counter block consists of a counter and counter switch. As shown in Figure 10-16. This block is used for center frequency setup or frequency measurement in the counter mode.

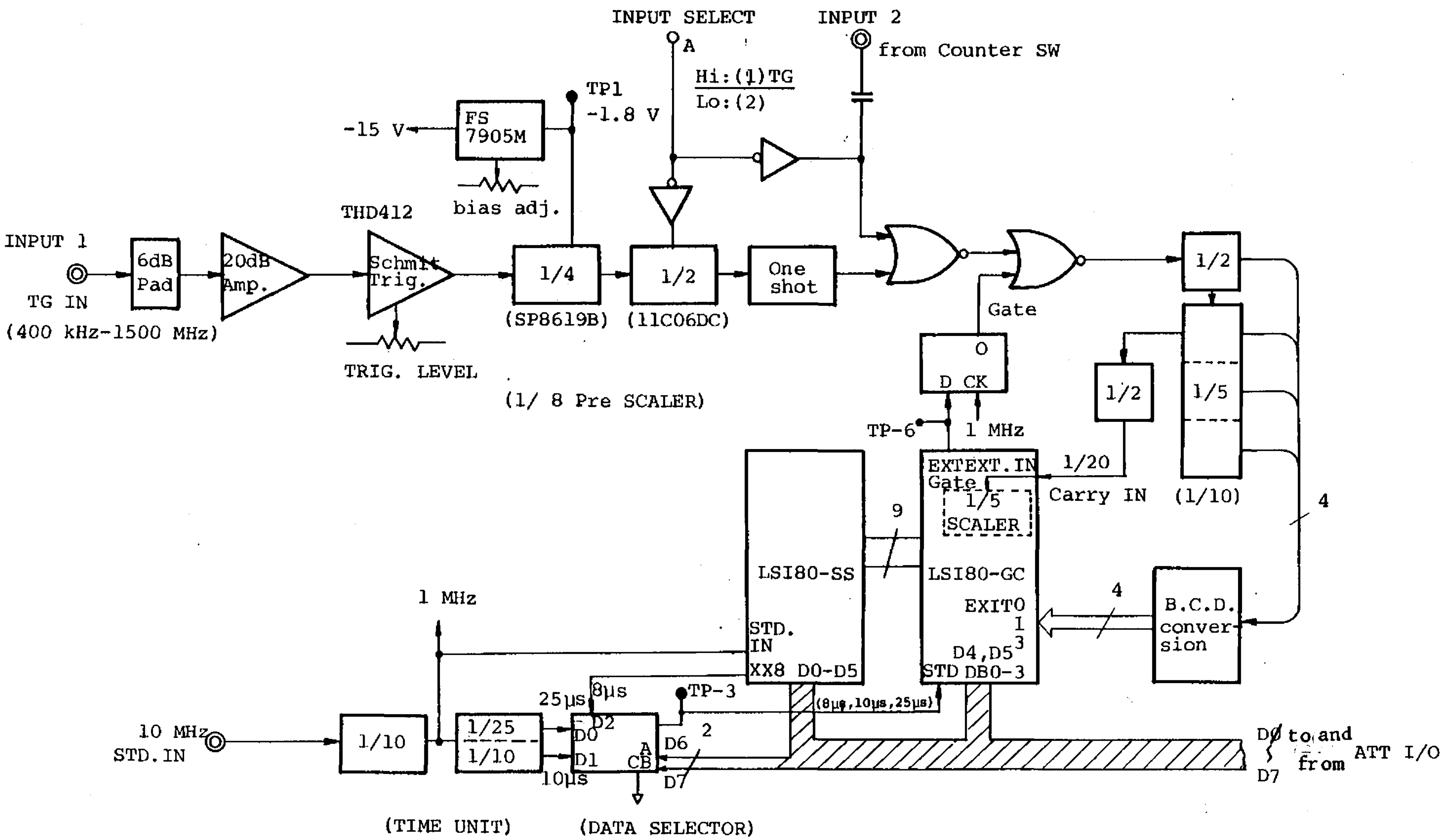


Fig. 10-15 Counter block configuration

(1) Counter (BLJ-010131) (Circuit diagram No. 74)
This counter covers a frequency range from 400 kHz to 1500 MHz. It has two inputs accepting the TG output and the output of the counter switch (Input-1 and Input-2). The TG output signal applied to Input-1 is amplified to a level adequate to drive the counter, goes through a Schmitt trigger circuit, divided by 4 and 2, and then coupled to the counter via a gate logic. Counter data and gate time setup information is furnished from the CPU via the ATT I/O block by the READ or WRITE signal. The signal for Input-2 is switched before the gate logic and treated in much the same way as the Input-1 signal.

(2) Counter switch (BLB-010505) (MEP-400) (Circuit diagram No. 75)
The counter switch selects one of the outputs of the third block 2 MHz VCO, 23 MHz VCO, first IF, RF block 204 MHz OSC, RF block 33.33 MHz, and third block 153.3 MHz, and couples it to the internal counter to read the selected output frequency.

10-3-11. Attenuator I/O (BGN-010220) (Circuit diagram No. 38)

This board takes out the following control data from the data bus to provide the corresponding control functions:

(1) Counter switch control
(2) Counter data send and receive
(3) TG attenuator control
(4) RF attenuator control
(5) DC-AC couple switching, Input 1 or 2 switching, and frequency response compensation

The frequency response compensation circuit creates a voltage to control the RF block gain according to the sweep and calibration signals to compensate for the frequency response slopes of the TR4172 attenuator, mixer, and so on. The addresses and data for each control signal are listed in Table 10-2.

Table 10-2 Attenuator I/O address and data

ADDRESS

A2	A1	A0	
0	0	0	Counter SW selection
0	0	1	Counter control
0	1	0	Counter data in/out
0	1	1	Tracking Generator Attenuator
1	0	0	RF input Attenuator
1	0	1	DC-cut, input select, RF level correction internal-standard ON/OFF, RF BW select.
1	1	0	Lock Interrupt Read

1) COUNTER SW SELECTION

DATA bit									
7	6	5	4	3	2	1	0		
0	0	0	0	0	0	0	1	T.G count	
0	0	0	0	0	0	1	0		
0	0	0	0	0	1	0	0	1st LOCAL IF	5 to 45 MHz
0	0	0	0	1	0	0	0	4th LOCAL	33.33 MHz
0	0	0	1	0	0	0	0	3rd LOCAL	153.33 MHz
0	0	1	0	0	0	0	0	3rd LOCAL 23 MHz VCO	about 23 MHz
0	1	0	0	0	0	0	0	3rd LOCAL 2 MHz VCO	about 2 MHz
1	0	0	0	0	0	0	0	2nd LOCAL	204.4 MHz

2) COUNTER CONTROL FUNCTION

DATA bit								
7	6	5	4	3	2	1	0	
					0			to counter latch out enable
				0				counter interrupt enable
			0/1					strobe
		0/1						select
0	0							counter time base 25 μ
0	1							counter time base 10 μ
1	0							counter time base 8 μ
1	1							

3) TG ATT. 4) RF ATT

DATA bit						RF ATT
5	4	3	2	1	0	
0	1	0	1	1	0	0 dB
0	1	1	0	1	0	-10 dB
1	0	0	1	1	0	-20 dB
1	0	1	0	1	0	-30 dB
1	0	0	1	0	1	-40 dB
1	0	1	0	0	1	-50 dB

5) DC CUT, INPUT SELECT, RF LEVEL CORRECTION, INTERNAL STD. ON/OFF RF BW SELECT.

DATA bit								
7	6	5	4	3	2	1	0	
							0/1	DC/AC
						0/1	0	INPUT1/INPUT2
			1	1	1			RF LEVEL CORRECTION
	0/1							RF BW SELECT (IF RBW 300 kHz to 10 Hz/1 MHz
1/0								INT. STD. ON/OFF

1: approximately +5 V
0: approximately 0 V

10-3-12. YIG OSCILLATOR I/O BGN-010219 (Circuit diagram No. 37)

This board takes out the following data from the data bus to provide the corresponding control functions:

(1) YIG OSC main tuning data
(2) YIG OSC FM tuning data
(3) YIG OSC sweep variable
(4) Sweep control (sweep attenuation, MAIN, FM, third sweep A, and third sweep B)
(5) YIG driver control
(6) First PLL block control
(7) Reference voltage source of ±10 Vdc

The data given in item 1, 2, and 3 above are converted from digital codes into the corresponding analog voltages, which are then applied to the YIG driver.
The addresses, data, and output voltages for each control signal are listed in Table 10-3.

Table 10-3 YIG I/O address and data

ADDRESS

A2	A1	A0	CONTROL FUNCTION
0	0	0	TUNING MAIN
0	0	1	
0	1	0	TUNING FM
0	1	1	SPAN CONTROL (1) (Variable)
1	0	0	SPAN CONTROL (2) (1, 1/10, 1/100, ZERO)
1	0	1	1st LOCAL LOCK CONTROL
1	1	0	1st LOCAL LOCK (100 MHz/101 MHz) CONTROL
1	1	1	1st LOCAL LOCK 1/N

1) SPAN CONTROL (2)

DATA bit								FUNCTION	
7	6	5	4	3	2	1	0		
				1	1	1	0	SWEEP MAIN.	SPAN > 10 MHz
				1	1	0	1	SWEEP FM	10 MHz ≥ SPAN > 500kHz
				0	1	1	1	3rd LO SWEEP A	500 kHz ≥ SPAN > 50 kHz
				1	0	1	1	3rd LO SWEEP B	50 kHz ≥ SPAN
1	1	1	0					1/1 SPAN	
1	1	0	1					1/10 SPAN	
1	0	1	1					1/100 SPAN	
0	1	1	1					ZERO SPAN	

2) 1st LOCAL LOCK CONTROL

DATA bit								FUNCTION
7	6	5	4	3	2	1	0	
	0	1	1	1	0	1	1	INITIAL
					1	0	0	LOCK ON
					0	1	1	LOCK OFF
			1	0				YIG OSC FILTER ON SPAN ≤ 10 MHz
			0	0				YIG OSC FILTER ON SPAN ≤ 500 kHz

3) 1st LOCAL LOCK (100 MHz/101 MHz) CONTROL

DATA bit								FUNCTION
7	6	5	4	3	2	1	0	
							0/1	1st LOCAL PLL ± +/-
		1	0	1	0	1		100 MHz/101 MHz LOCK N=5
		0	1	1	1	0		N=4
	1							1st LOCAL IF COUNTER OUTPUT
		1	1					100 MHz/101 MHz OSC OFF

1: approximately +5 V
0: approximately 0 V

10-3-13. Third Local I/O Board ~~BGN-010221~~ (Circuit ~~diagram~~ No. 39)

This board takes out the following data from the data bus to provide the corresponding control functions for the third local block and TG block:

(1) Third Local Tune 1
(2) Third Local Tune 2
(3) Third Local Tune 3
(4) Third Local PLL 1/N Data
(5) Third Local Control (PLL, filter, counter switch)
(6) TG Control (Normal, Tune, Phase)

Tunes 1, 2, and 3 are used to set up the tuning voltages for the 23 MHz VCO and 2 MHz VCO by adding them to the sweep signal furnished from the YIG I/O board. The addresses, data, and output voltages of each control signal are listed in Table 10-4.

Table 10-4 Third Local I/O address and data

ADDRESS

A2	A1	A0	CONTROL FUNCTION
0	0	0	3rd LOCAL TUNING A
0	0	1	
0	1	0	3rd LOCAL TUNING B
0	1	1	3rd LOCAL TUNING C
1	0	0	3rd LOCAL LOCK I/N
1	0	1	3rd LOCAL PLL, 2 MHz VCO FILTER, COUNTER OUTPUT
1	1	0	TG CONTROL

1) 3rd LOCAL PLL, 2 MHz VCO FILTER, COUNTER OUTPUT

DATA bit					FUNCTION
4	3	2	1	0	
			1	1	3rd LOCAL PLL. LOCK ON SPAN ≤ 50 kHz
			0	1	2 MHz VCO FILTER SPAN ≤ 10 kHz
0	0	1			2 MHz VCO COUNTER OUT. CONTROL
0	1	0			23 MHz VCO COUNTER OUT. CONTROL
1	0	0			153.3 MHz COUNTER OUT. CONTROL

2) TG CONTROL

DATA bit					FUNCTION
4	3	2	1	0	
0	0	0	0	0	TG OFF
0	0	1	0	1	TG ON
0	0	1	1	0	TUNE MODE
1	0	1	0	1	PHASE 3.33 MHz OUTPUT ON

1: approximately +5 V

0: approximately 0 V

10-3-14. RF Section Power Supply (Mother, RF Power)

BLK-010226 BLF-010370

The RF section contains the following DC supply voltages:

+12 V, +15 V, -15 V, and +5 V

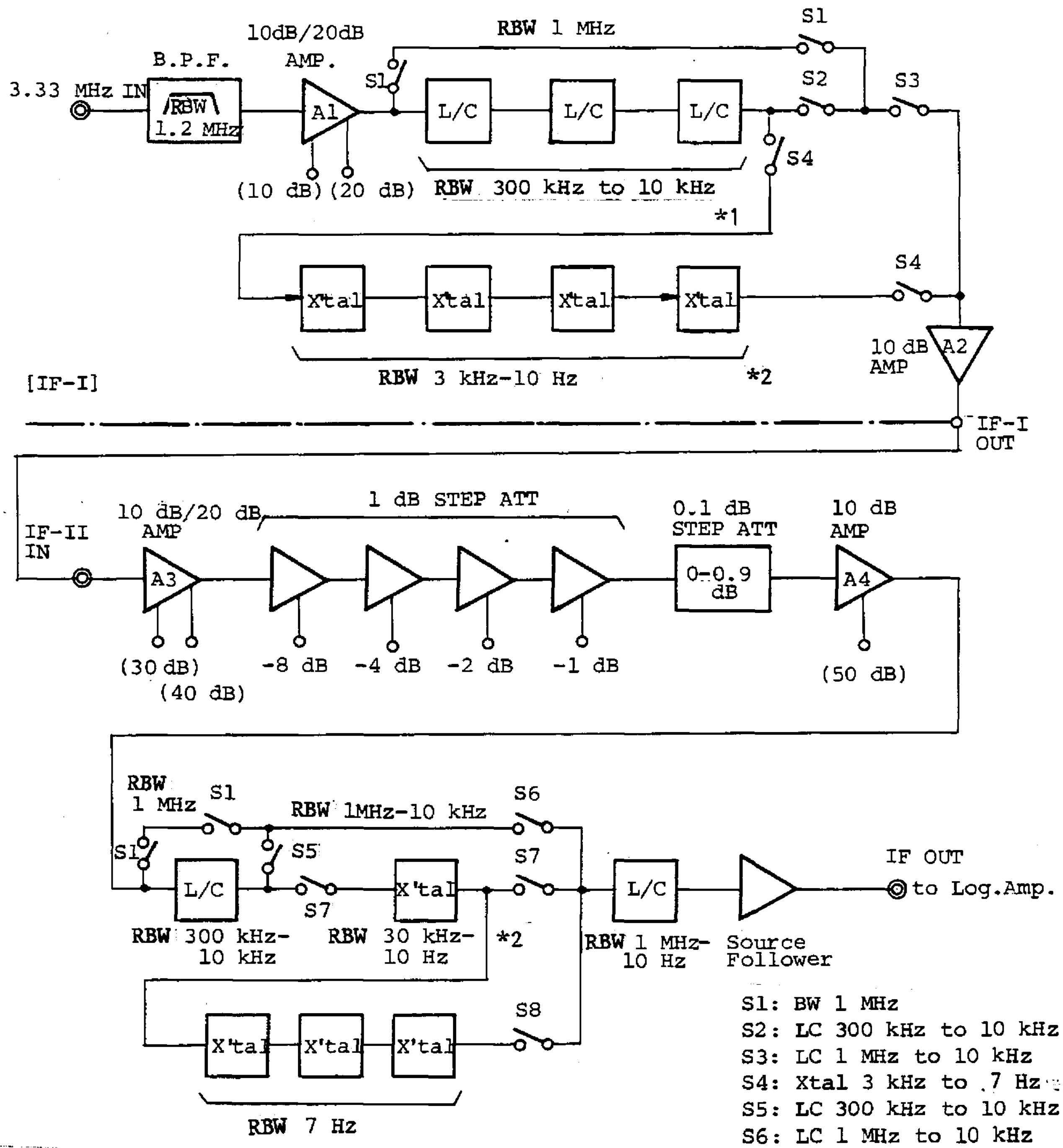
The +12 VDC is supplied to the thermostatic oven for the time base quartz-controlled oscillator and for memory back-up. It is left active as long as the power cable of the instrument is plugged into an AC power source. Note that unregulated voltages are also available. Each DC supply circuit has its own fuse and thermostat just before each voltage regulator.

10-4. DISPLAY SECTION FUNCTIONAL BLOCK DESCRIPTION

10-4-1. IF Block (MEP-338) BLP-010229 (Circuit diagram No. 25, 26)
BLP-010230 (Circuit diagram No. 27, 28, 29)

The IF block consists of an RBW to display the 3.33 MHz IF signal from the RF section, amplifier (with 10 dB gain) to control reference levels, and attenuators.

Figure 10-17 shows the configuration.



Note:

*1 When RBW ≤ 3 kHz, 30 kHz RBW is selected.

*2 When RBW is 7 Hz, 10 Hz RBW is selected.

Fig. 10-16 IF block configuration

The IF block is divided into IF-I and IF-II boards. The IF-I board holds three LC filters and four quartz filters. It performs RBW selection and signal path switching according to the control signal furnished from the IF-II board. The IF-II Board holds a 10 dB amplifier, attenuators with 1 and 0.1 dB steps, two LC filters, four quartz filters, and control circuit. Table 10-5 shows the control signals.

Table 10-5 IF control signals address and data

ADDRESS

A2	A1	A0	CONTROL FUNCTION
0	0	0	RESOLUTION BAND WIDTH
0	0	1	SWITCH CONTROL
0	1	0	STEP AMP 10 dB
0	1	1	1 dB ATT, 0.1 dB ATT.

1) RESOLUTION BAND WIDTH

DATA bit								RBW
7	6	5	4	3	2	1	0	
			1	0	0	0	0	1 MHz
			1	0	0	1	0	300 kHz
			1	0	1	0	0	100 kHz
			1	0	1	1	0	120 kHz
			1	1	0	0	0	30 kHz
			1	1	1	1	0	10 kHz
1	1	1	0	1	1	1	0	9 kHz
1	1	1	0	1	0	0	0	3 kHz
0	0	0	0	1	0	0	0	1 kHz
0	0	1	0	1	0	0	0	300 Hz
0	1	0	0	1	0	0	0	200 Hz
0	1	1	0	1	0	0	0	100 Hz
1	0	0	0	1	0	0	0	30 Hz
1	0	1	0	1	0	0	0	10 Hz
1	1	0	0	1	0	0	0	7 Hz

2) SWITCH CONTROL

DATA bit								RBW
7	6	5	4	3	2	1	0	
1	0	1	1	0	1	0	1	RBW 1 MHz
1	0	1	1	0	1	1	0	RBW 300 kHz to 10 kHz
0	1	0	0	0	1	1	0	RBW 9 kHz (OPTION 01)
0	1	0	0	1	0	0	0	RBW 3 kHz to 10 Hz
1	1	0	0	1	0	0	0	RBW 7Hz

3) STEP AMP 10 dB

DATA bit								STEP AMP
7	6	5	4	3	2	1	0	
0	0	0	0	0	0	0	1	10 dB
0	0	0	0	0	0	1	0	20 dB
0	0	0	0	0	1	1	0	30 dB
0	0	0	0	1	0	1	0	40 dB
0	0	0	1	1	0	1	0	50 dB

4) 1 dB ATT 0.1 dB ATT

DATA bit				0.1 dB ATT
7	6	5	4	
0	0	0	1	0.1 dB ATT
0	0	1	0	0.2 dB ATT
0	0	1	1	0.3 dB ATT
0	1	0	0	0.4 dB ATT
0	1	0	1	0.5 dB ATT
0	1	1	0	0.6 dB ATT
0	1	1	1	0.7 dB ATT
1	0	0	0	0.8 dB ATT
1	0	0	1	0.9 dB ATT

DATA bit				1 dB ATT
3	2	1	0	
0	0	0	1	1 dB ATT
0	0	1	0	2 dB ATT
0	0	1	1	3 dB ATT
0	1	0	0	4 dB ATT
0	1	0	1	5 dB ATT
0	1	1	0	6 dB ATT
0	1	1	1	7 dB ATT
1	0	0	0	8 dB ATT
1	0	0	1	9 dB ATT
1	0	1	0	10 dB ATT
1	0	1	1	11 dB ATT
1	1	0	0	12 dB ATT
1	1	0	1	13 dB ATT
1	1	1	0	14 dB ATT
1	1	1	1	15 dB ATT

10-4-2. Logarithmic Amplifier Block (MEP-337) BLP-010231

(Circuit diagram No. 30)

Figure 10-18 shows the Log Amplifier block configuration.

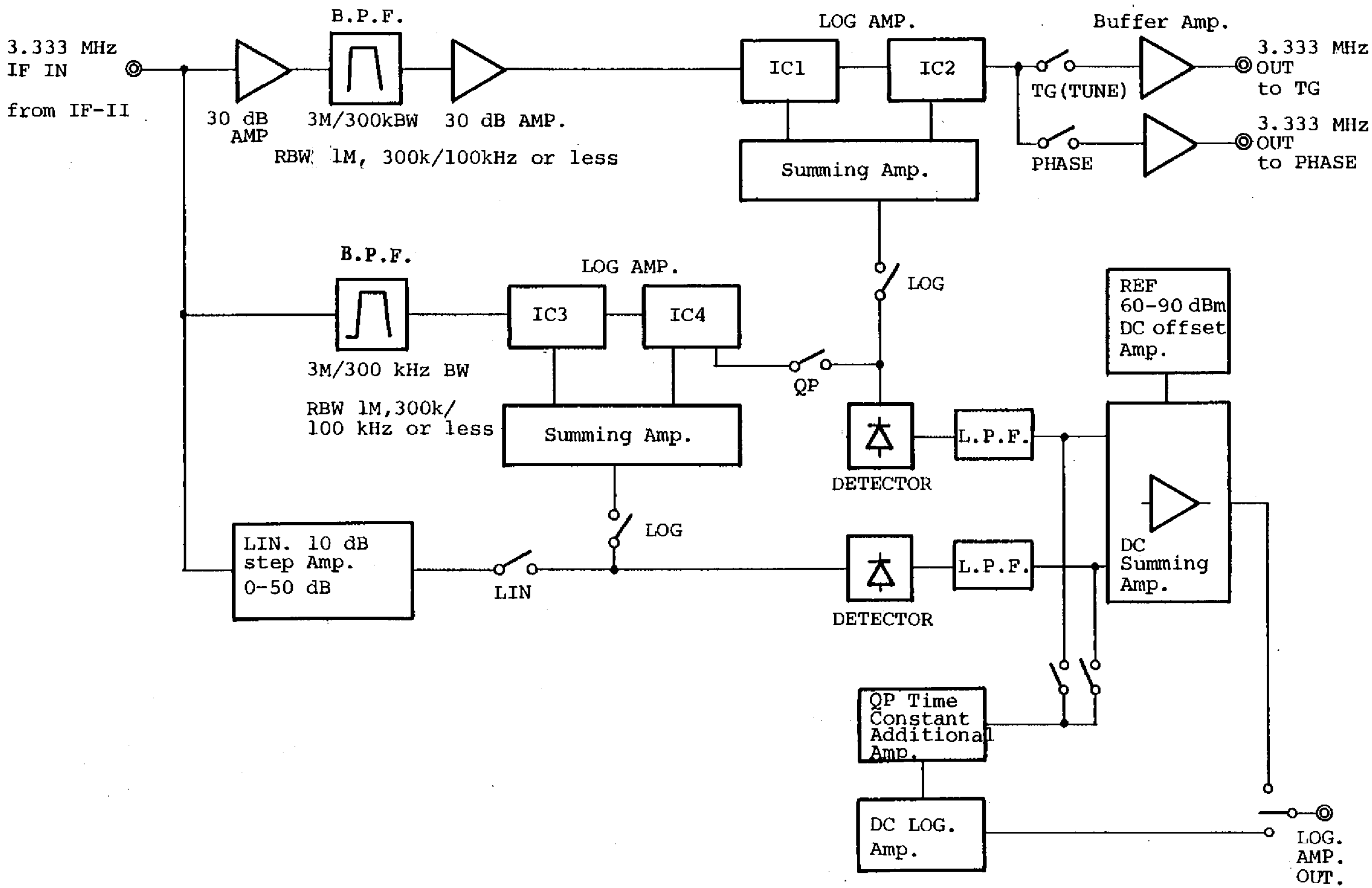


Fig. 10-17 Log. Amp. configuration

The Log Amplifier compresses the output of the IF block into logarithmic scale, and converts it into DC voltage.
In the Log mode, the 3.33 MHz IF signal is coupled to IC3 and IC4, where it is amplified by 60 dB. The output of these ICs are coupled to IC1 and IC2, where it is compressed into logarithmic scale. IC1 and IC2 handle signal levels between -60 and -100 dB, while IC3 and IC4 handle those between 0 and -50 dB.
The output of these IC1 and IC2 are added by IC5 and IC6 and converted to be dc voltage and output.
In the Linear mode, the 3.33 MHz IF signal is coupled to a linear amplifier with 10 dB step gain, where it is amplified, and then detected before output.
In the QP mode, the output voltage obtained in the Log mode is added to that obtained in the Linear mode. The resulting signal is output after adding the charging/discharging time constants specified in the C.I.S.P.L. standard.

10-4-3. Phase Block (MEP-339) BLP-010205 (Circuit diagram No. 31, 32)

Figure 10-18 shows the phase block configuration.

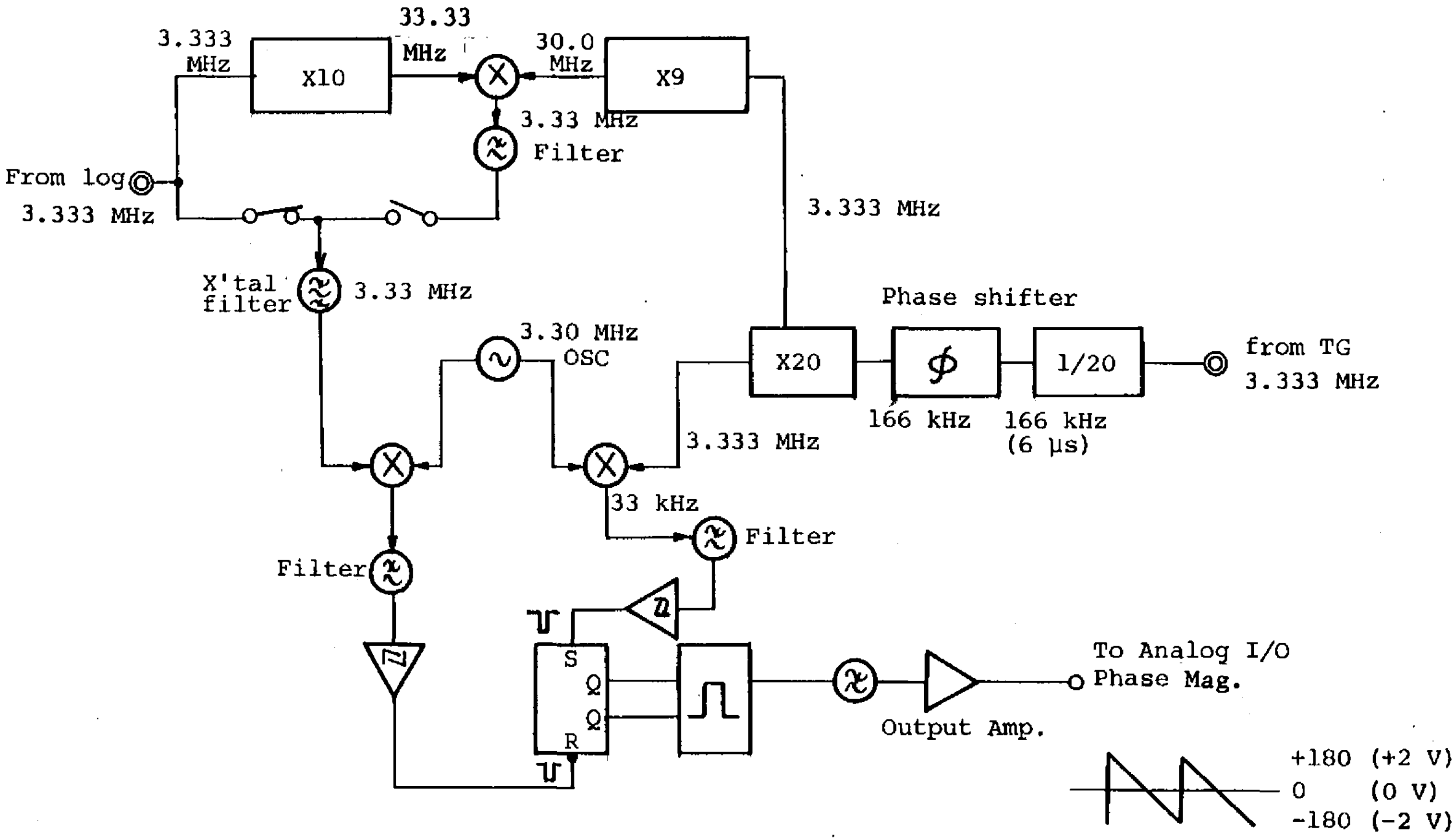


Fig. 10-18 Phase block configuration

On the TR4172, phase information is displayed on its video monitor be exercising phase comparison between the TG time base signal of 3.333 MHz and the final IF signal (i.e. the output of the Log Amp.) for the input signal.
The time base signal of 3.333 MHz furnished from the tracking generator is first divided by 20 into 166 kHz. It then goes to a phase shifter circuit for electrical length compensation, where the signal phase is made variable, before being multiplied again by 20 into 3.333 MHz. This 3.333 MHz time base signal and another 3.333 MHz IF signal from the Log Amplifier are both down-converted with a 3.30 MHz local frequency into 33 kHz, which is coupled to a phase detector. The output of the phase detector is output to the analog I/O board (to be described later) via an LPF.
To detect and display small phase differences, a 33.33 MHz (which is obtained by multiplying-by-10 the 3.333 MHz IF signal from the Log Amp.) and the 3.333 MHz time base signal (which is obtained by multiplying-by-9 the 30.000 MHz IF signal from the TG) are mixed together into 3.33 MHz when the phase range is 4 deg/div. or below. This 3.33 MHz is phase-compared with the 3.33 MHz time base signal from the tracking generator. As a result, a phase difference ten times larger can be obtained, which allows display of small phase differences.

10-4-4. CRT Driver (BGK-010184) (Circuit diagram No. 10)

The CRT driver accepts the X and Y signals from the analog I/O board to drive the CRT display. It contains a CRT bias voltage, blanking, dynamic focus, and other circuits.
Along with the blanking function, the blanking circuit also provides a function to intensify only signal response traces on the display by using the ΔY signal supplied from the analog I/O board, so that the traces are clearly visible in contrast with other information display (such as messages, labels, or scale).
In order to compensate for the focus characteristics of the CRT, the dynamic focus circuit uses a ramp voltage to control the focus voltage to obtain even focus over the entire screen.

10-4-5. High Voltage (BLP-010204) (Circuit diagram No. 9)

This circuit generates high voltage for the CRT. Figure 10-20 shows the circuit configuration. Table 10-6 shows typical CRT bias voltages.

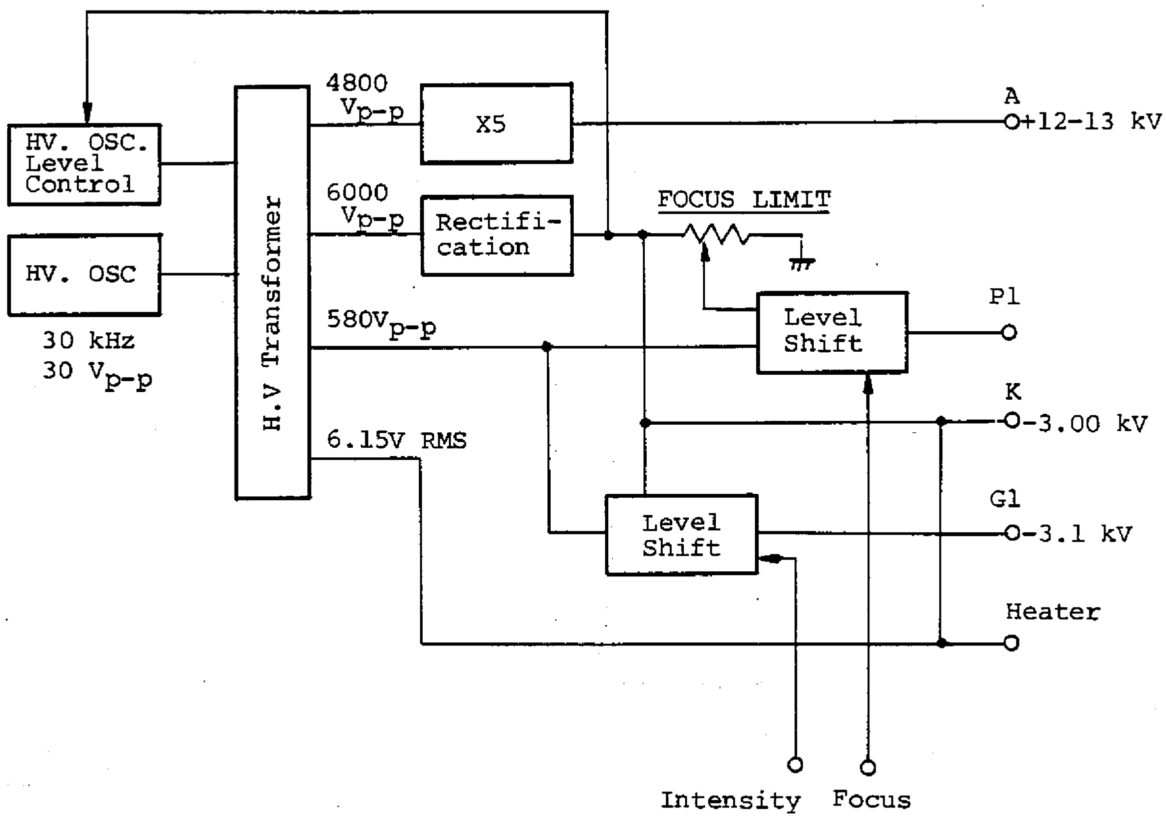
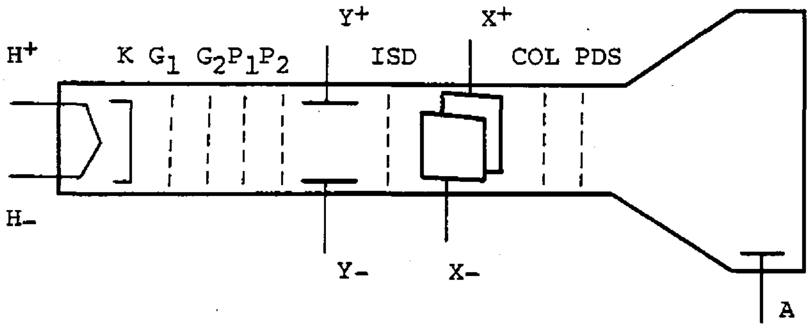


Fig. 10-19 High voltage circuit configuration

Table 10-6 CRT bias voltage



A	12 to 13 kV
k	-3 kV
G_1	-3 to -3.1 kV
G_2	68 to 88 V
P_1	-2.4 kV
P_2	0 to 135 V
ISD	0 to 135 V
COL	0 to 135 V
PDS	0 to 135 V
H	6.15 V RMS

A sine wave of approximately 30 kHz in frequency and 30 Vp-p in amplitude is generated by a blocking oscillator. The output of this oscillator is stepped up by a high voltage transformer into approximately -3 kV, which is used as a cathode voltage for the CRT. Part of this voltage is fed back to the oscillator to stabilize the oscillation.

An anode voltage is boosted by the booster block into +12 to +13 kV. The intensity and focus voltages furnished from the CRT driver control the potentials at G1 and P1 electrodes of the CRT respectively.

10-4-6. Ramp Generator (BGP-010185) (Circuit diagram No. 11)

The ramp generator consists of a saw-tooth generator for X-axis sweep and a sweep trigger circuit. Sweep time can be set up between 1 μs and 1000 sec either by controlling the input current to the integrating circuit (by means of a D-A converter) or switching the integrating capacitors and input resistors. The output voltage to the display section is from -5 V to +5 V, while that to the RF section is from +5 V to -5 V.

10-4-7. Analog I/O (BGP-010186) (Circuit diagram No. 12)

The analog I/O board contains a DC amplifier section which performs A-D conversion on the input signal from the LOG and Phase blocks, and line generator, character display, and scale display sections which, in combination, processe the X and Y signals furnished from the D/A board and outputs to the CRT driver.

(1) Log Mag Amp section
Consists of a DC amplifier for switching between 10, 5, 2, and 1 dB.

(2) Phase, GD Mag Amp section
Consists of a DC amplifier for switching between 80, 40, 20, ... 0.2 deg/div.

(3) Video Filter section
1 MHz to 1 Hz LPF and 1-3 step switching circuit.
The outputs of these three circuits are output to the A/D board, where they are converted into digital codes and processed by the CPU.

(4) Line generator section
This section contains an integration circuit which smoothes the step-like output of the D/A converter.

(5) Character display section
This section adds character voltage to the X and Y voltages from the D/A board to display character information, such as labels or readouts, on the display.

(6) Graticule display section

This section displays the graticule of 10 x 10 divisions on the screen.

See paragraph 10-4-14 for basic display operations.

10-4-8. A-D Converter Section (BGP-010187) (Circuit diagram No. 13)

(1) A-D converter

A-D converter section contains a peak detector (for the Y signal furnished from the analog I/O board) and A-D converter. It converts the X signal (furnished from the ramp generator) into digital code and outputs it on the data bus.

(2) Peak detector circuit

There are four detection modes: Normal, Positive, Negative, and Sample modes. The Normal mode detects whether the input voltage is increasing or decreasing. If the voltage is increasing, it automatically selects the positive detector; if the voltage is decreasing, it automatically selects the negative detector. In either case, the detector holds the peak level.

Figure 10-20 shows the circuit operation timing.

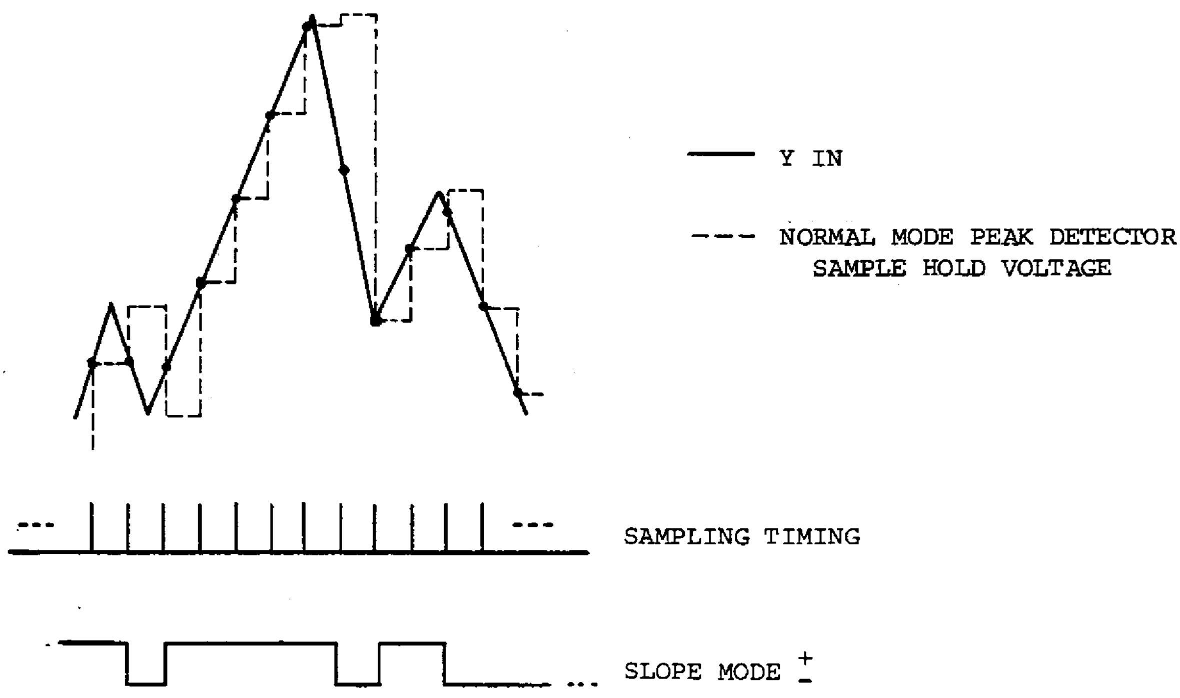


Fig. 10-20 Peak detector normal mode timing chart

(3) A/D converter circuit

The voltage held by the detector circuit is analog - to digital converted by a successive approximation A-D converter to generate a Y signal. The ramp voltage is analog - to digital converted by a follow up approximation A-D converter to generate an X signal.

10-4-9. D/A Converter (BGP-010188) (Circuit diagram No. 14)

The D/A converter reads data in the spectrum, character, line, and some other display modes (to be described later) by a control signal furnished from the display controller, converts it into the X and Y signals, and outputs them to the analog I/O board.

10-4-10. Display Control (BGP-010189) (Circuit diagram No. 15)

The display control provides various display control signals and timing to display data in different display modes which will be described later.

10-4-11. I/O and GP-IB (BGP-010190) (Circuit diagram No. 16, 17)

The I/O and GP-IB section consists of the following five circuits:

(1) CS signal generator for each I/O in the display and RF sections. The CS signal is used to activate the function selected from the keyboard.
(2) Timing controller for control signals
(3) Interrupt input circuit
(4) Address bus control for D/A board memory
(5) GP-IB interface (TMS9914)

10-4-12. CPU (BGP-010191) (Circuit diagram No. 19, 20)

The CPU section consists of a Z80 processor, ROM (8 kbytes), RAMs (64 kbytes dynamic RAM, which holds data after A/D conversion), clock generator, reset circuit, and others.

10-4-13. Memory Key Control (BGP-010192) (Circuit diagram No. 21, 22)

This section consists of 64 kbyte-ROMs, 8 kbyte-RAM and key control circuit.
The 8 kbyte-RAM is used for data save and recall operations. It is backed up by an internal battery so its contents are left intact even when the instrument is switched off. The battery can hold the memory contents for approximately two weeks.
The key control provides all control over all the keys on the display and RF sections, LED indicators, and data read operations using the DATA knob.

10-4-14. Display Operation

The CRT display on the TR4172 uses the random scan system, in which information display is made by specifying the X and Y coordinate values on the screen. The display modes include the following five modes:

(1) Character display
(2) Line display
(3) Spectrum display
(4) Graphic display
(5) Analog display

Each of these modes (jobs) is illustrated in Figure 10-22.

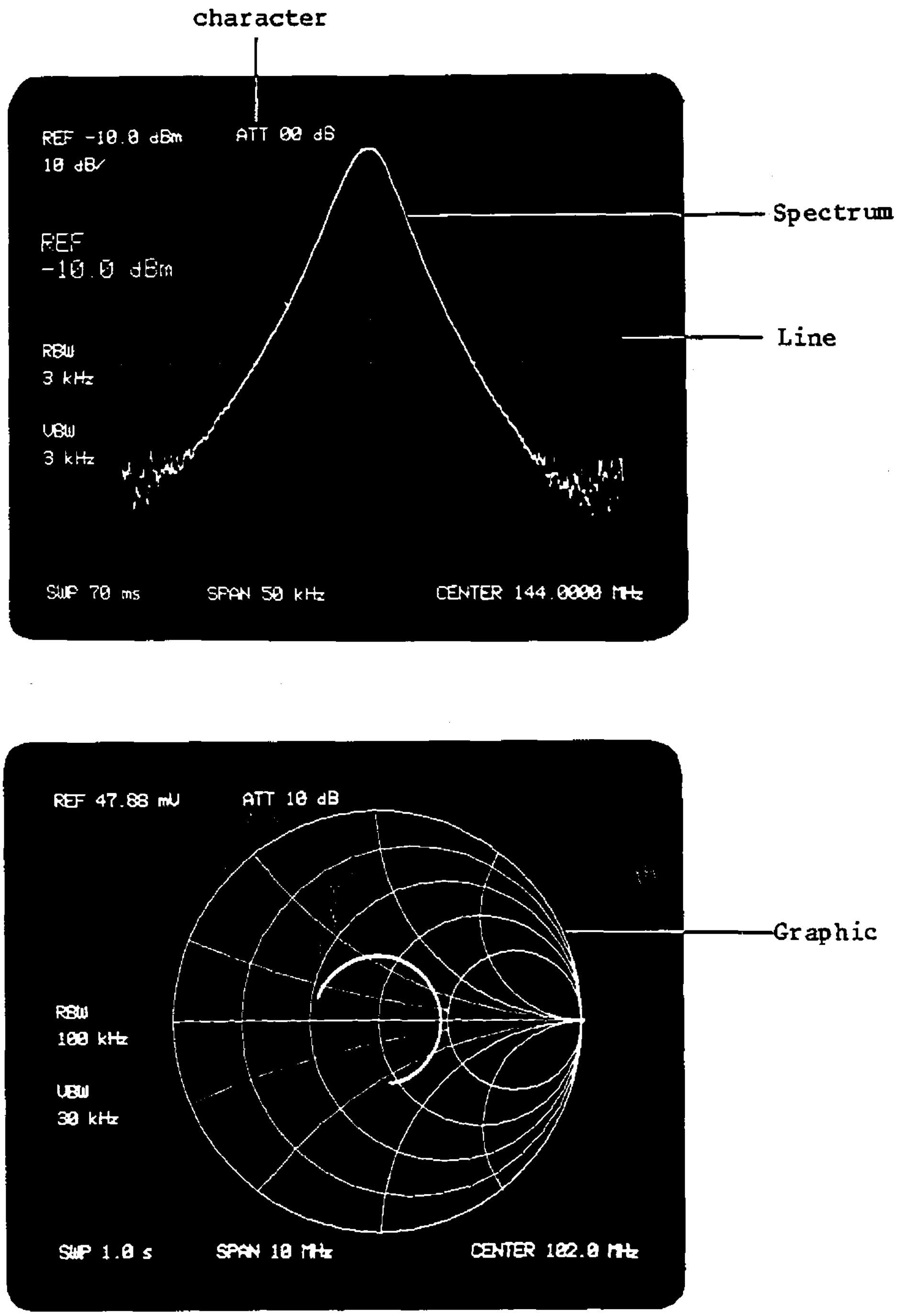


Fig. 10-21 Display modes

Display operation starts with fetching the specified job contents from the job memory in the display control. Control signals and timings are determined according to this job memory contents, and are output to the analog I/O board. Figure 10-22 shows a flowchart for display operation.

Display flowchart

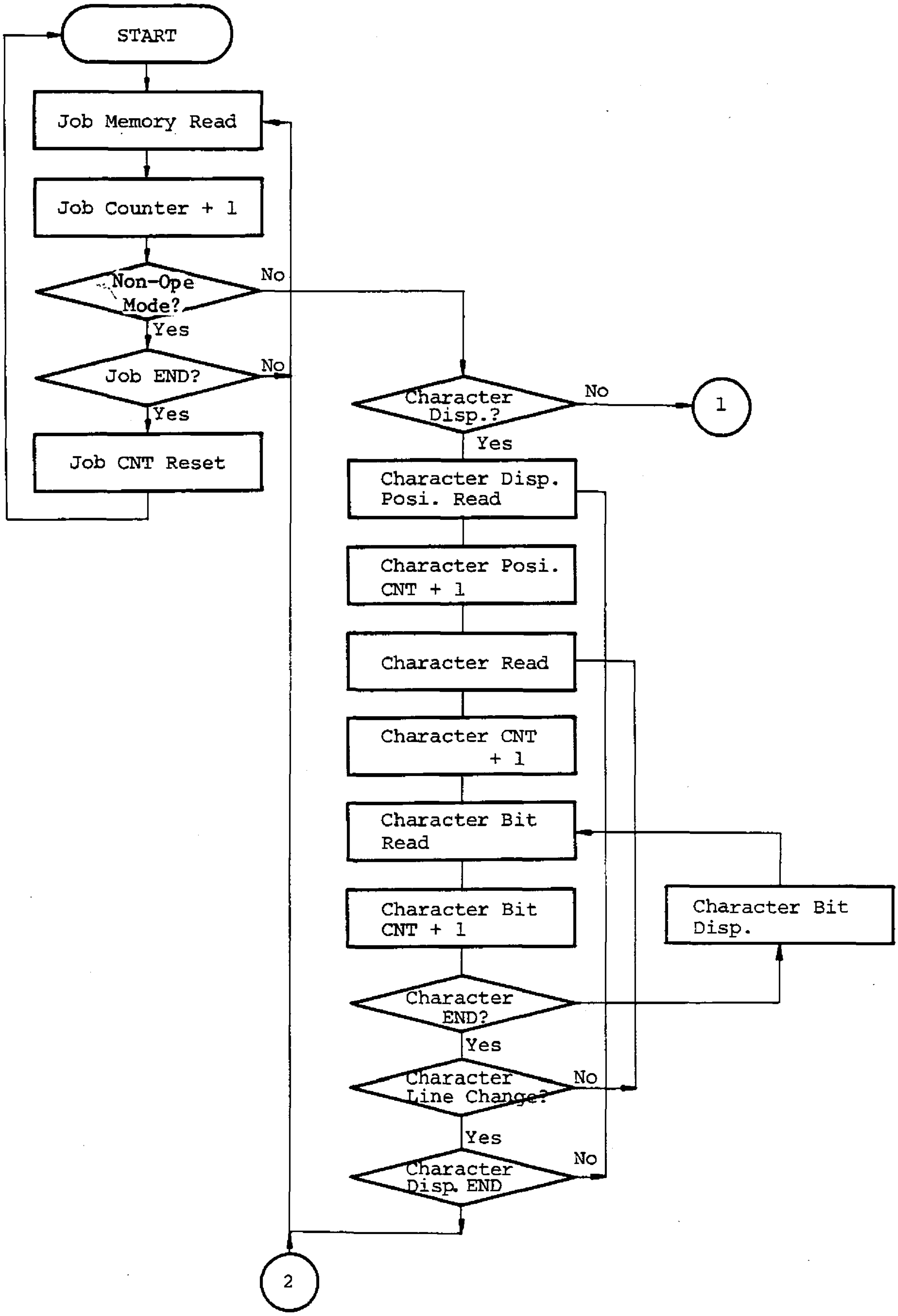


Fig. 10-22 Display operation flowchart

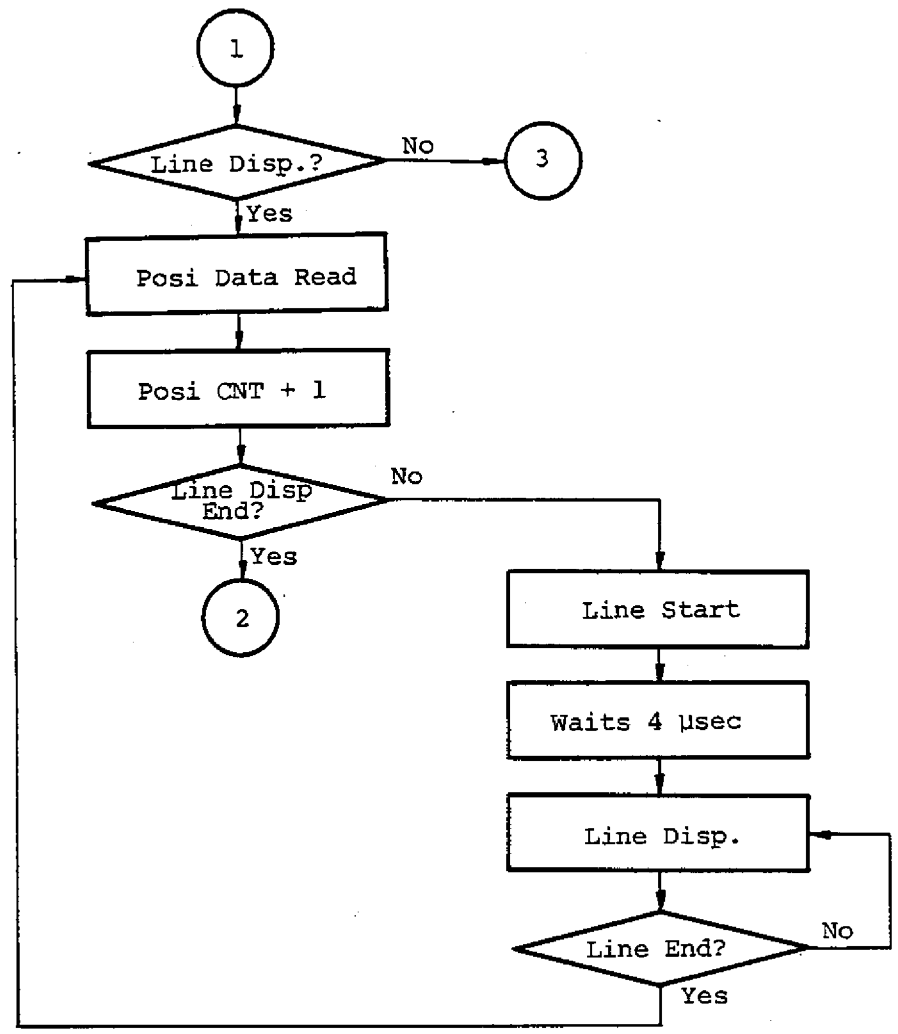


Fig. 10-22 Display operation flowchart (Cont'd)

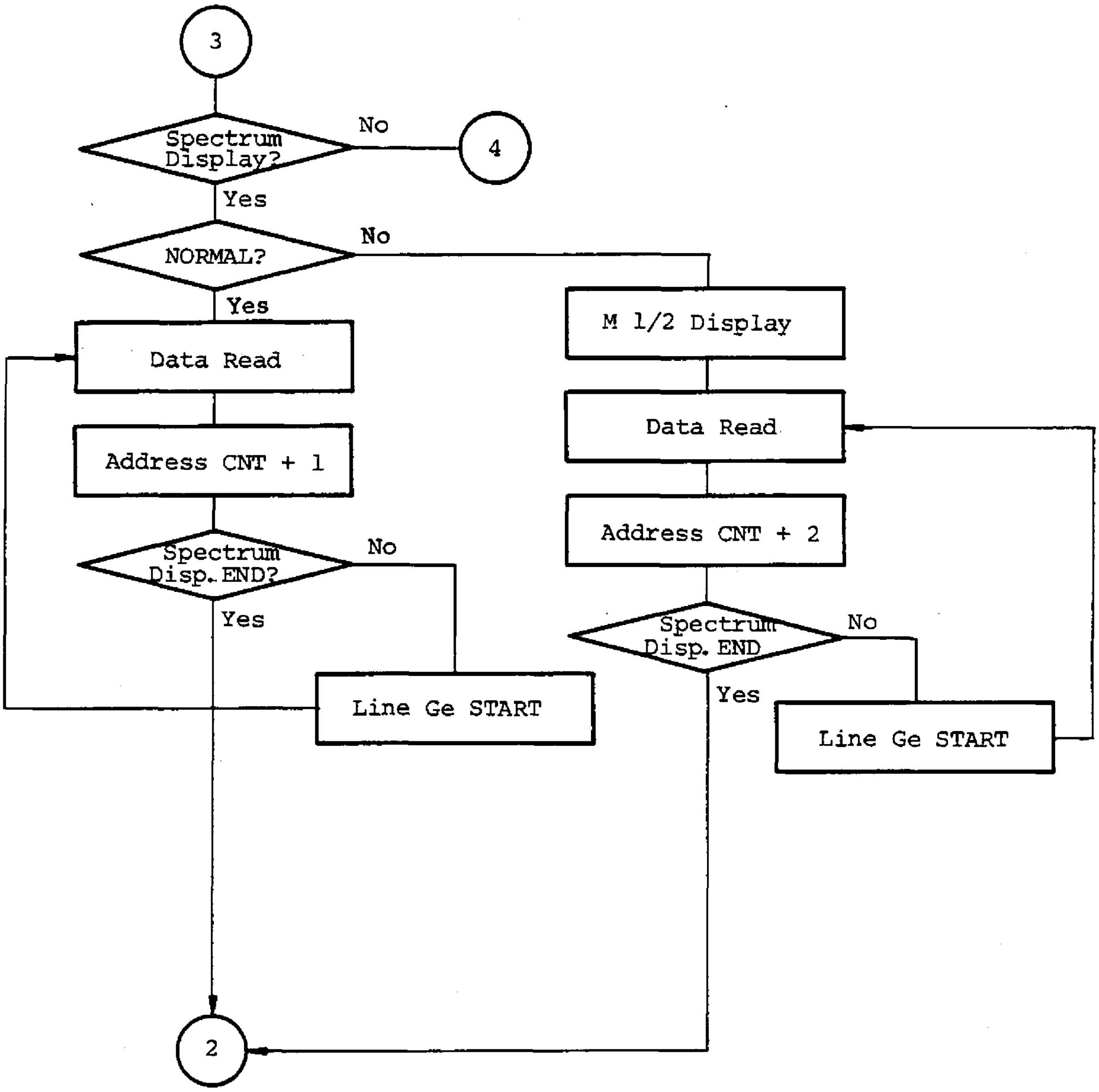


Fig. 10-22 Display operation flowchart (Cont'd)

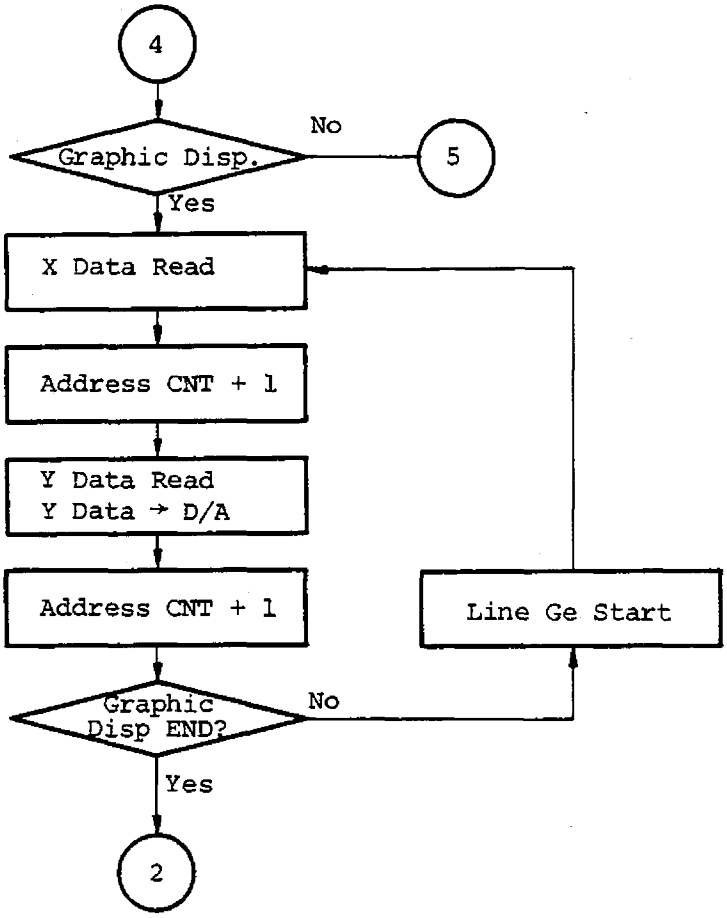


Fig. 10-22 Display operation flowchart (Cont'd)

(1) Character display

Figure 10-23 shows a block diagram relating to character display operation. Character information includes all labels, setup information, and readouts on the display operation.

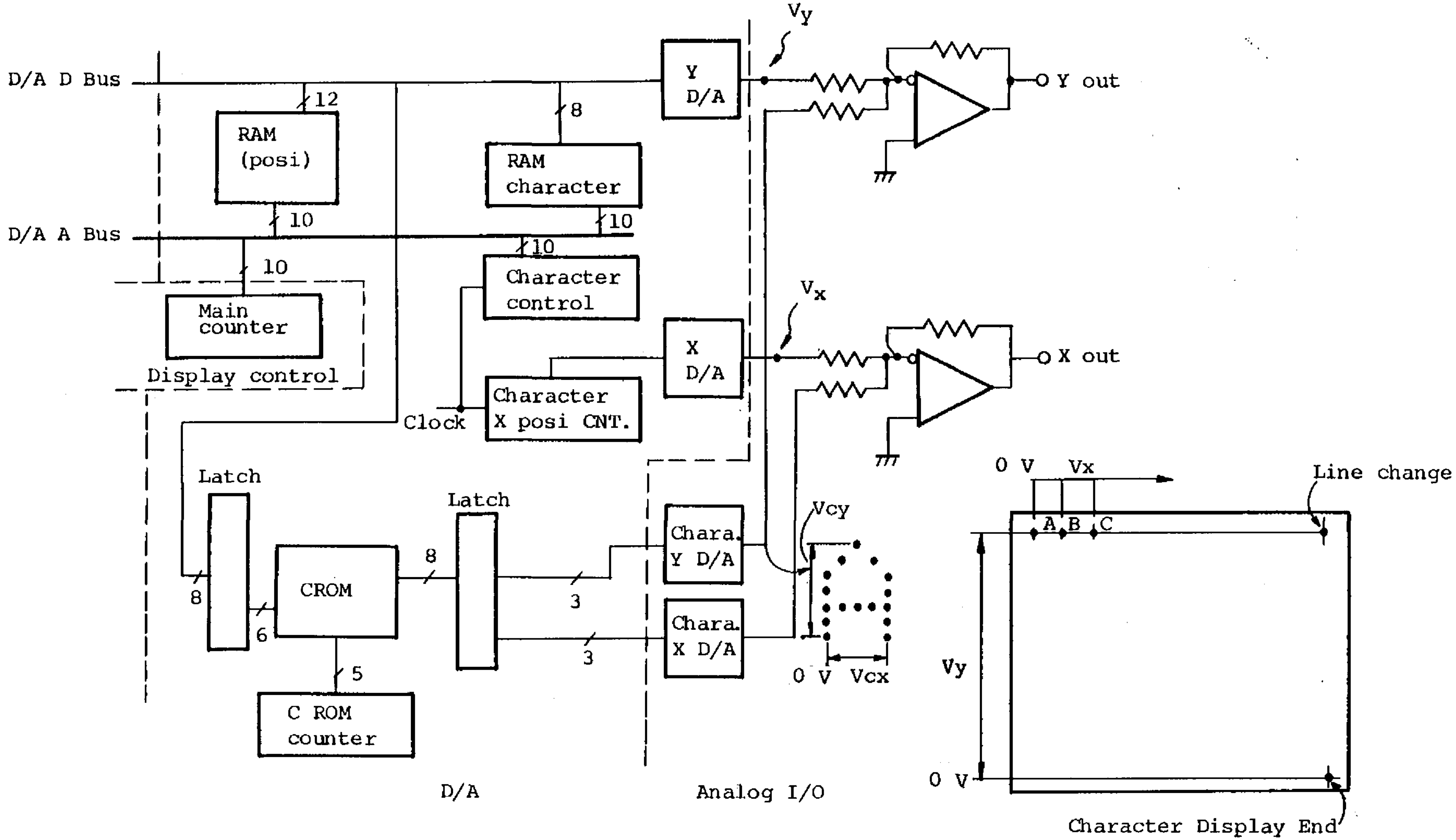


Fig. 10-23 Character display block diagram

When a character is to be displayed, the pertinent data is fetched from the RAM (position) on the D-A board to determine the Y axis position, is subjected to A-D conversion, and then output as Y OUT signal (V(y)). To determine the X axis position, output from the character X position counter output is subject to D-A conversion, and then output as X OUT signal (V(y)). Then, the pertinent character data is fetched from the character RAM. The character data causes the pertinent character to be read from the character ROM. The CX and CY data (each 3 bits) for character display are then output to the analog I/O board, where they are each subject to D/A conversion into Vcx and Vcy voltages, and added to Vx and Vy voltages to be shown on the display.

After this operation sequence is executed to all the characters to be displayed, the control proceeds with the next job fetch.

(2) Line display

Figure 10-24 shows a block diagram relating to line display. The line display shows the graticule (10 x 10) and display line on the display.

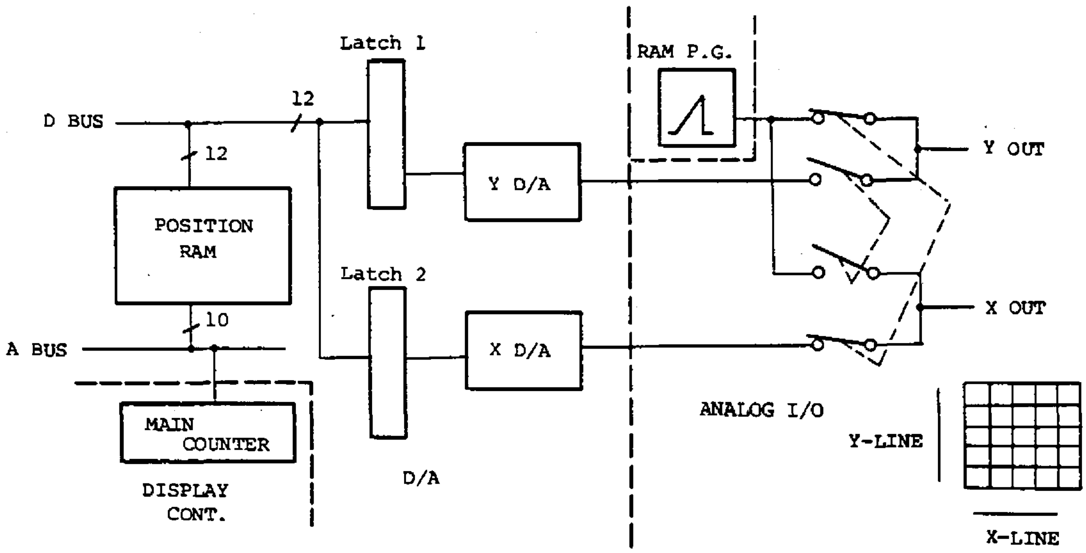


Fig. 10-24 Line display block diagram

When an X line is to be displayed, RAM (position) data is set into latch 1, is subjected to D-A conversion, and is output as Y OUT voltage to determine the Y line position. An X line can be displayed if the switch is operated so that a ramp voltage is output from the analog I/O board. The X line display sequence is repeated 10 times before the Y line is displayed. For Y line display, the RAM data is set into latch 2, is subject to D/A conversion, and is output to X OUT to determine the Y line operation. A ramp voltage is applied to Y OUT to display a single Y line. The Y line display sequence is repeated 10 times to display the complete graticule.

The display line can be obtained in much the same way as the X line display operation.

(3) Spectrum display

Figure 10-25 shows a block diagram relating to spectrum display.

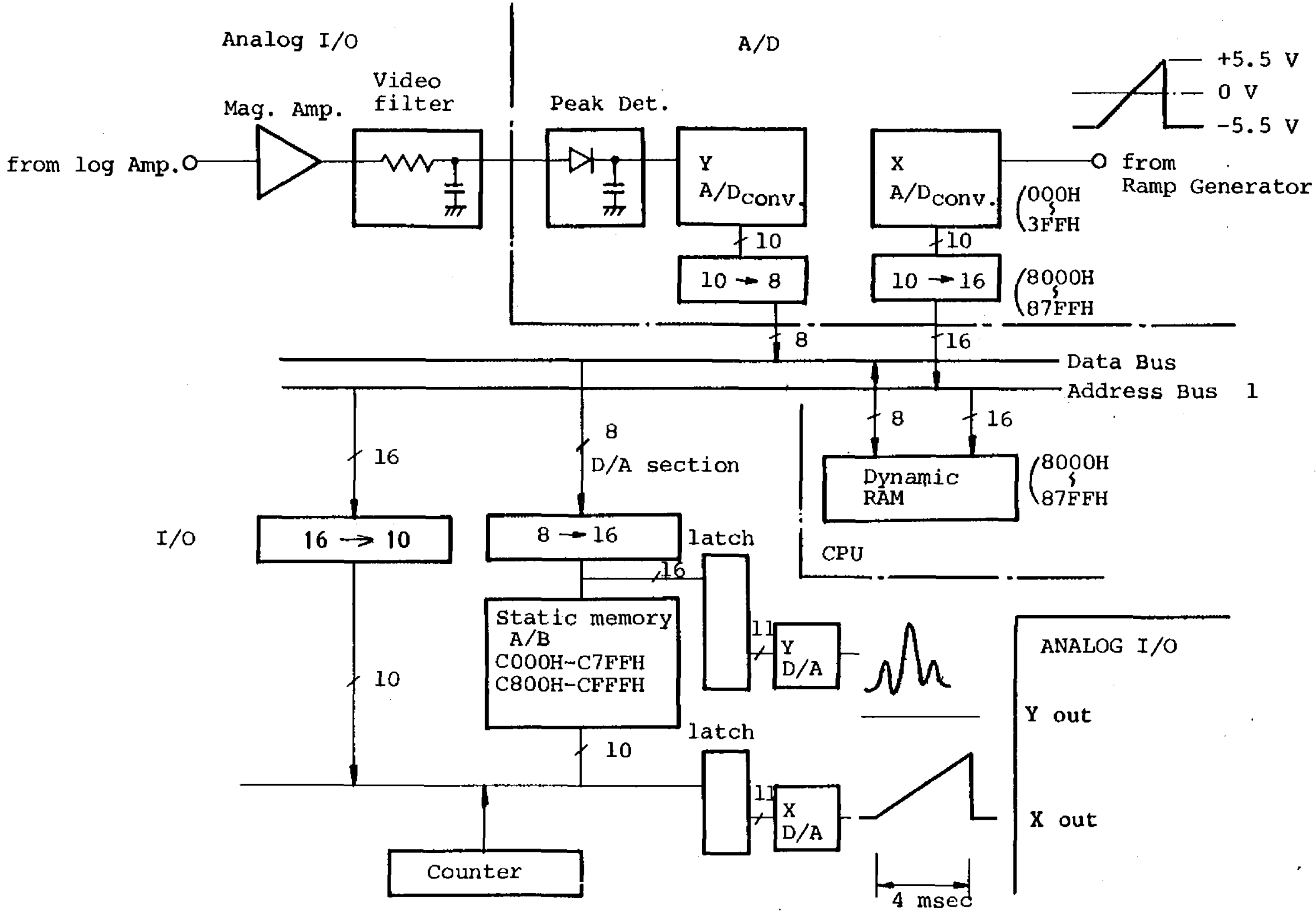


Fig. 10-25 Block diagram for spectrum display

The spectrum display mode is used for signal phase and response display. The X and Y signals which were subjected to A/D conversion on the A/D board, are first stored in the dynamic RAM on the CPU board, processed by CPU, then transferred to the static RAM on the D/A board. The static RAM includes memory A and B, either of which is selected according to panel setup. The contents of the RAM are set into X and Y latches, subject to D/A conversion, then output to the analog I/O board to be displayed.

(4) Graphic display

Figure 10-26 shows a block diagram pertaining to graphic display.

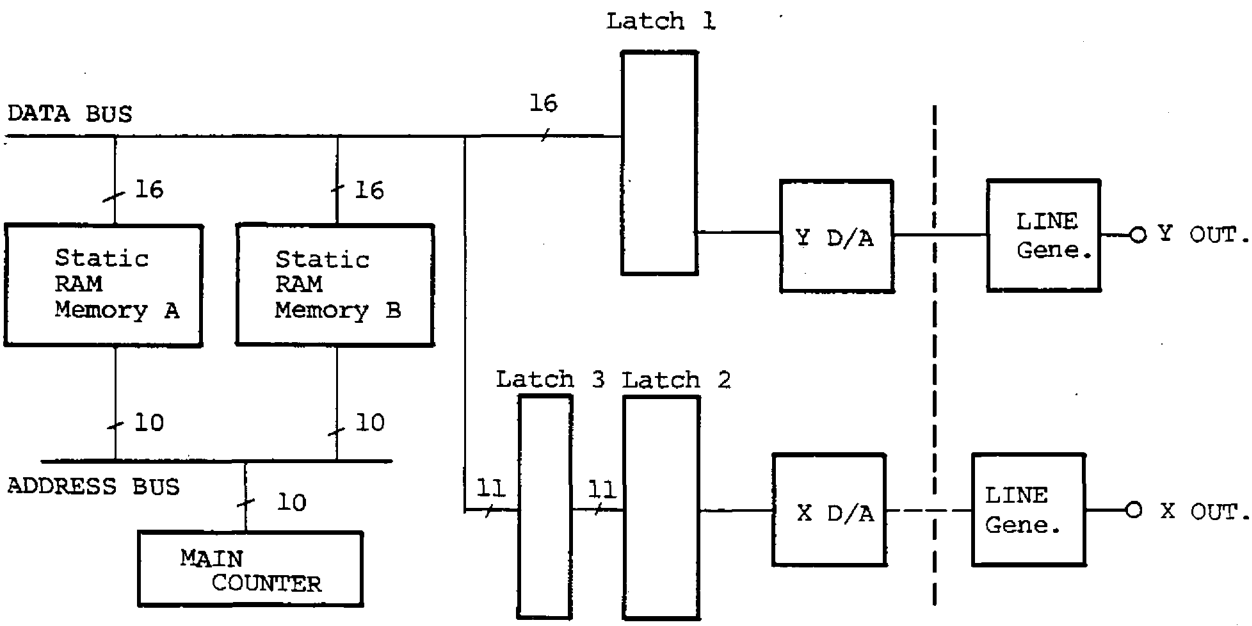


Fig. 10-26 Block diagram for graphic display

Two pages of graphic display are supported by memories A and B. Each memory holds X data at address 0=0 and Y data at address 0=1 respectively. Since each dot is assigned two bytes of data, the maximum number of data in one page is 512 points. X data is set into latch 3 when Address 0=0, while the contents of latch 3 is set into latch 2 when Address 0=1 and Y data is set into latch 2. Data set into each latch subject to D/A conversion to provide a single point of display on the CRT. The graphic display as shown in Figure 10-27 is obtained by repeating the above sequence.

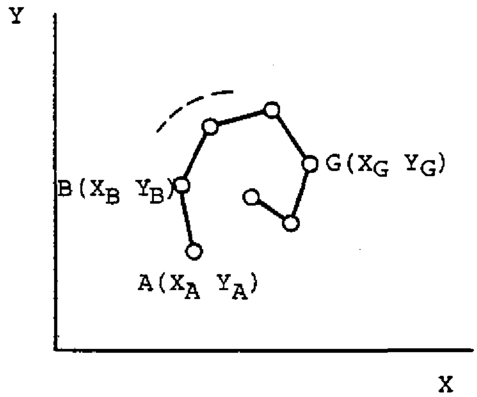


Fig. 10-27 Graphic display on the monitor

(5) Analog display

In the analog display mode, the video filter output on the analog I/O board is directly displayed on the monitor, with no digital processing performed on the display signal. This mode is effective only when zero frequency span and a sweep time of 19 ms or less is selected. It may be convenient to check the modulation signal component on the time axis.

MEMO

SECTION 11

CALIBRATION AND ADJUSTMENT

11-1. GENERAL

This section describes the calibration procedure for the TR4172 Spectrum Analyzer. After the instrument is serviced, be sure to carry out performance check and calibration.
For quick part identification, the part numbers and symbols printed or inscribed on PC boards or schematic diagrams are used throughout this section.

11-2. PREPARATION AND GENERAL PRECAUTIONS

The tools and instruments required for calibration are listed in the following table. Use the recommended instruments in the list or their equivalents.

11-2-1. Tools and Instruments Required for Calibration

Table 11-1 Measuring instruments required

Instrument	Specifications	Recommended model
(1) Synthesized signal generator	Frequency range: 500 kHz to 1000 MHz Output level: +10 to -30 dBm Output impedance: 50 Ω Output level flatness: ±0.5 dB Frequency accuracy: 2×10^{-8}	
(2) Synthesized function generator	Frequency range: 1 Hz to 20 MHz Output level: +10 to -30 dBm Output impedance: 50 Ω Output level flatness: ±0.2 dB Frequency accuracy: Approx. 10^{-8}	
(3) Frequency counter:	Frequency range: Up to 4 GHz Input level: +20 to -30 dBm Input impedance: 50 Ω Frequency accuracy: 2×10^{-9}	TR5211 (ADVANTEST)

Table 11-1 Measuring instruments required (Cont'd)

Instrument	Specifications	Recommended model
(4) Spectrum analyzer with tracking generator	Input frequency range: 100 kHz to 4 GHz Tracking generator output: 400 kHz to 2 GHz T.G. output flantness: ±1 dB Impedance: 50 Ω	TR4111A, TR4151 (ADVANTEST)
(5) Marker generator	Frequency: 1 MHz, 50 kHz, 5 kHz Full power: Approx. 0 dBm Impedance: 50 Ω	
(6) Power meter	Frequency range: 100 kHz to 1800 MHz Sensitivity: -30 to +20 dBm Accuracy: ±0.2 dB Impedance: 50 Ω	
(7) Digital voltmeter	Measurement range: 0V to ±1000 V Accuracy ±0.1%	TR6841 (ADVANTEST)
(8) High voltage probe	Voltage range: More than 20 kV Impedance: More than 1000 MΩ	TR1116 (ADVANTEST)
(9) Oscilloscope	Frequency: Approx.100MHz Sensitivity: 5mV	
(10) DC voltage standard	Output voltage: +15 V	
(11) High impedance probe	Measurement range: DC to 500MHz	
(12) Attenuator	Frequency range: DC to 500 MHz Attenuation: 0-100 dB at 10 dB steps 0-11 dB at 1 dB steps Accuracy: ±0.2 dB at 10 dB steps ±0.02 dB at 1 dB steps Impedance: 50 Ω	
(13) Scale		

Table 11-2 Jigs and tools required for adjustment

Item	Stock No.	Remarks
Input cable	MI-02	BNC-BUC (Short)*
Interconnecting cable	MI-61	BNC-BNC (Long)*
Interconnecting cable	MC-37	BNC-SMA
Interconnecting cable	MM-14	SMA-SMA
Interconnecting cable	MC-36	BNC-UM
Interconnecting cable	MM-17	UM-UM

Table 11-2 Jigs and tools required for adjustment (Cont'd)

Item	Stock No.	Remarks
N (P) to BNC (J) conversion adapter	JUG201	JNG-20A/U*
UM to UM linear adapter		UM-QA-JJ
SMA to SMA adapter		HRM-501
· Extender board		(double, 28pins)
· Extender board		(single, 22pins)
· Extender board		(single, 28pins)

Items marked with an asterisk (*) are standard supply accessories.

11-3. PREPARATION

(1) The local line voltage at which the instrument should be operated is 100, 120, 200 Vac ±10% or 240 Vac +4%, -10% (50/60 Hz).

(2) Before connecting the instrument to an AC outlet, be sure to set the POWER switch to STANDBY.

(3) The calibration ambient temperature should be 20 to 30°C at a relative humidity of less than 80%. The calibration site should be free from dust, vibration, and noise.

11-4. TIME BASE CALIBRATION

The time base oscillator contained in the analyzer is calibrated before shipment. The frequency standard used for calibration has an absolute accuracy of 1×10^{-10} (secondary factory standard). When checking or calibrating the time base oscillator accuracy, use a frequency standard having the frequency accuracy equivalent to or better than the above mentioned absolute value.

	Type A	Type B	Type C
Aging rate	5×10^{-9}/day	2×10^{-9}/day	5×10^{-10}/day
	5×10^{-8}/month	2×10^{-8}/month	1×10^{-8}/month
Long-term stability	8×10^{-8}/year	5×10^{-8}/year	2×10^{-8}/year
Temperature characteristic (0°C to 50°C)	$\pm 5 \times 10^{-8}$	$\pm 1 \times 10^{-8}$	$\pm 5 \times 10^{-9}$

Instruments required: Frequency standard (with absolute accuracy of more than 1×10^{-10}
Frequency comparator

(1) The time base oscillator output has a 10 MHz frequency and a level of approximately 5 V (TTL compatible). When [SHIFT] [LABEL] [7] keys are pressed subsequently, the oscillator output is output at the INT. STD. OUTPUT (J4) connector on the rear of the instrument. The frequency accuracy of the oscillator output can be adjusted by the STD ADJ. screwdriver adjustment next to the J4 connector.

(2) Prepare the measuring system as Figure 11-1, and adjust the STD ADJ. until the accuracy of each type of instrument is determined.

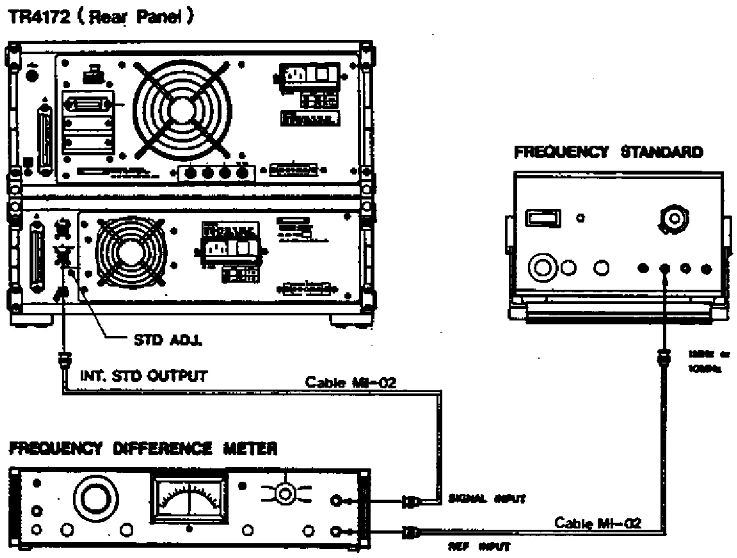


Fig. 11-1 Time base calibration

11-5. DISPLAY SECTION ADJUSTMENT

This paragraph describes the display section adjustment procedure.

11-5-1. Supply Voltage Adjustment (Board No. BGC-010198) (Circuit diagram No. 5)

Instrument required: Digital voltmeter

(1) Set the POWER switch to ON, and check the supply voltage at each point. The location of voltage adjustment and test points are shown in Figure 11-2.

(2) Using the voltage adjustments corresponding to each test point, adjust supply voltage until within specifications listed in Table 11-3.

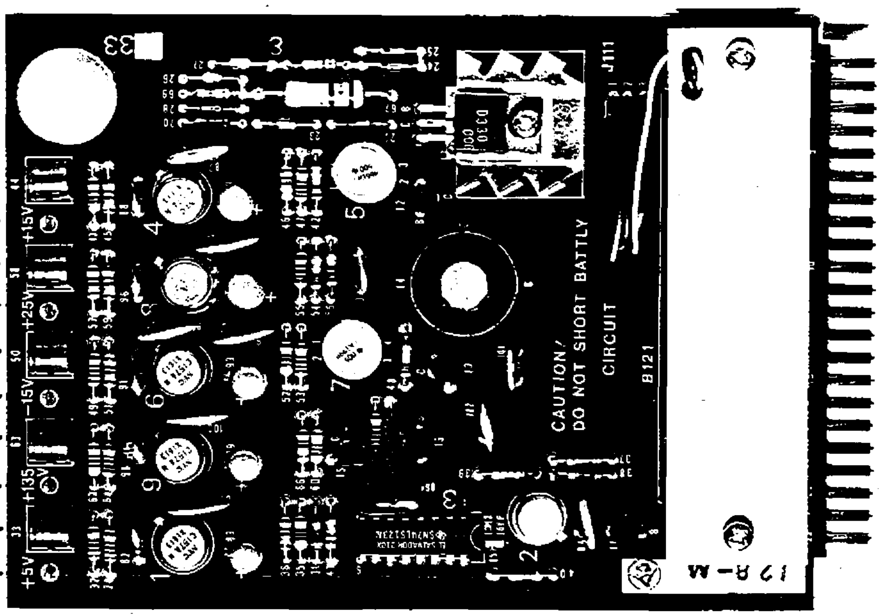


Fig. 11-2 Supply voltage adjustments and test points on the DISPLAY POWER 1 board (BGC-010198)

Table 11-3

Test point	Voltage	Adjustment
TP-4	+25 V ±0.01 V	R58
TP-5	+15 V ±0.01 V	R44
TP-2	+135 V ±0.2 V	R63
TP-3	-15 V ±0.01 V	R50
TP-1	+5 V ±0.05 V	R33

11-5-2. High Voltage Unit Adjustment and Check (BLC-0101204)
(Circuit diagram No. 9)

Instruments required: Digital voltmeter
High voltage probe

(1) Set the POWER switch to STANDBY.

(2) Remove phase block (MEP-339) from the instrument. (See Figure 11-3.)

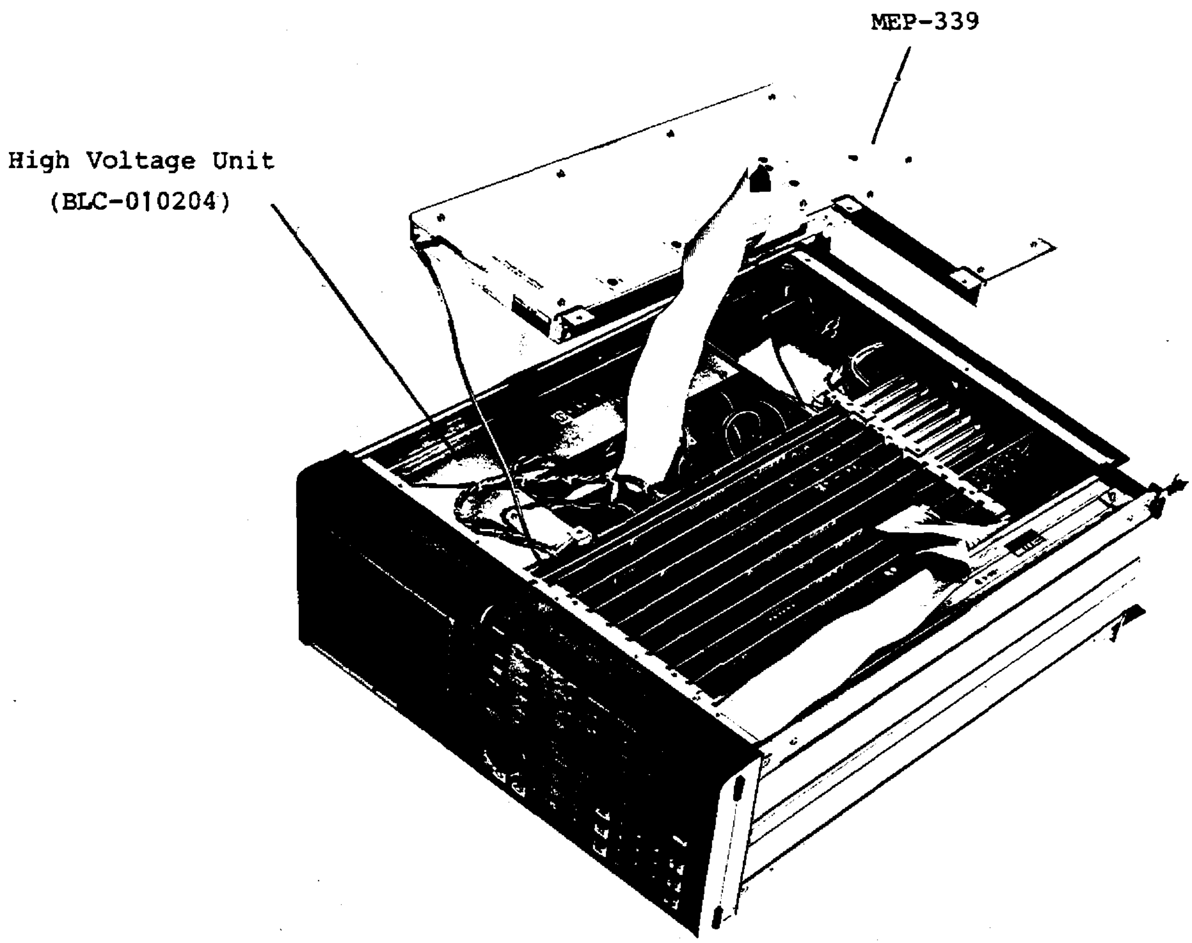


Fig. 11-3 Removing the phase block (MEP-339)

(3) Remove the High Voltage Unit (BLC-010204) from the display section, then temporarily secure it to the top left edge of the case as shown in Figure 11-4.

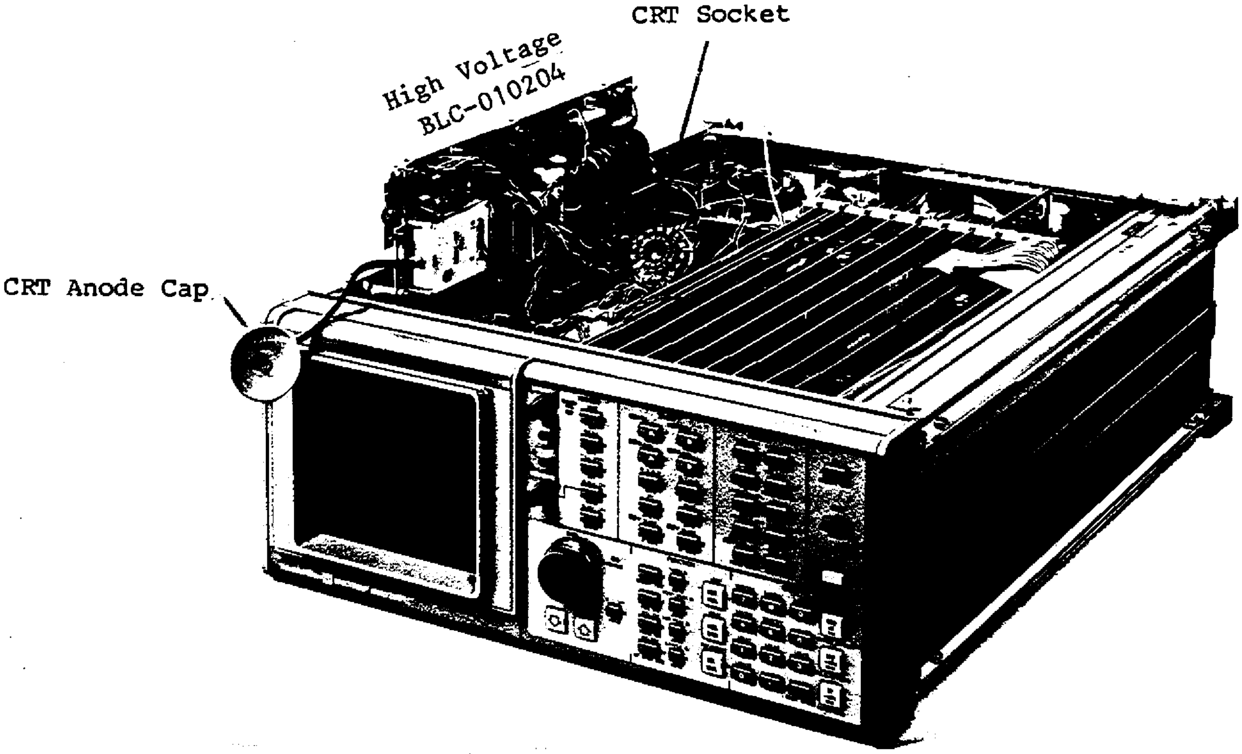


Fig. 11-4 Adjusting high voltage unit

(4) Disconnect the CRT anode cap and CRT socket from the CRT. High potential charges may remain at the anode cap or CRT socket. Exercise utmost caution to avoid electrical shock. Leave all connectors other than the anode cap and CRT socket connected in their original sockets.

(5) After verifying that neither the anode cap nor CRT socket is in contact with the chassis or other components, set the POWER switch to ON.

(6) Adjust R62 until the voltage across the test point TP K and the GND (chassis) is -3.000 kV. Use a high voltage probe and a digital voltmeter for voltage check. Be sure that the impedance of the high voltage probe matches the input impedance of the digital voltmeter.

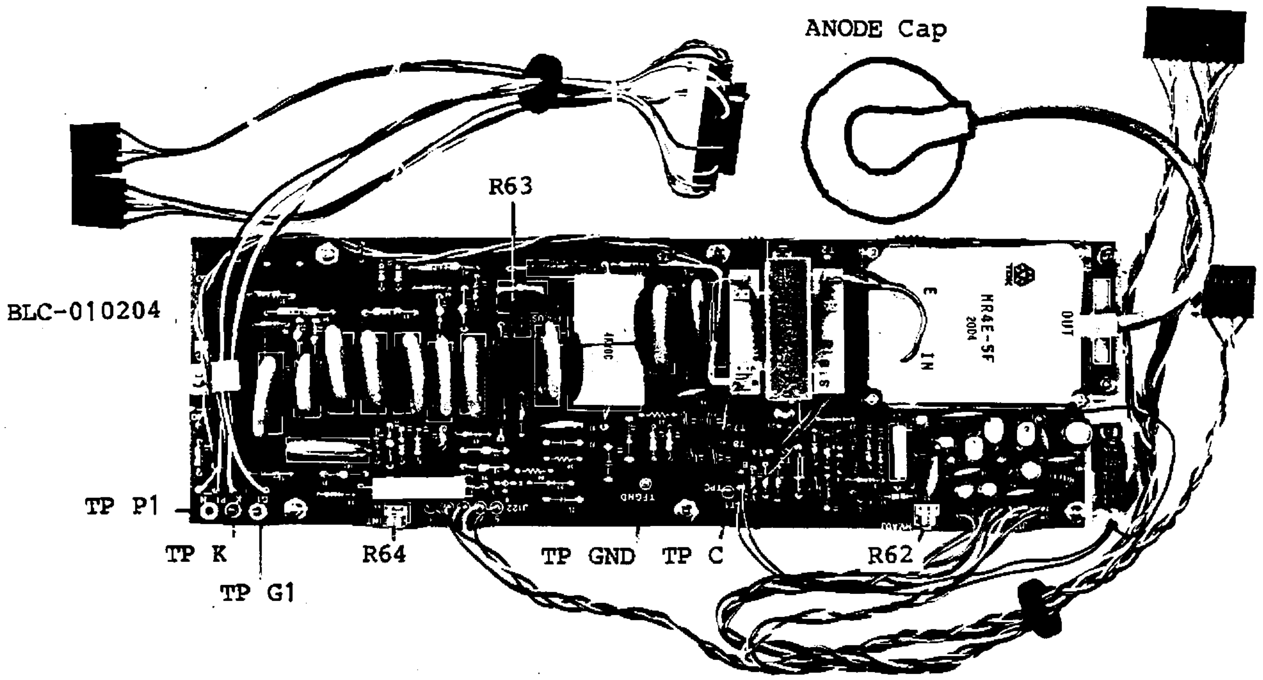


Fig. 11-5 Adjustments and test points on the high voltage unit (BLC-0101204)

(7) Verify that the voltage across the anode cap and the GND (chassis)is +12 to +13 kV. While checking this voltage, exercise caution to avoid electrical shock.

(8) Set the POWER switch to STANDBY. While monitoring the anode cap voltage with the digital voltmeter, discharge the anode cap.

(9) After verifying that the anode cap potential is lowered to the safety voltage, connect it to the CRT.

(10) Remount the high voltage unit (BLC-0101204) at its original position in the chassis, then connect the CRT socket to the CRT. Remount the phase block to its original position in the chassis.

11-5-3. CRT Driver and Bias Adjustment (Board: BGK-010184)
(Circuit diagram No. 10)

Instrument required: Oscilloscope
Digital voltmeter

(1) Set the POWER switch to STANDBY. Pull out the CRT driver board (BGK-010184) and remount it in the same slot using an extender board (28 pins,single). The cables to the on-board connectors J281 and J282 should be connected to the board by extender cables. Set the POWER switch to ON.

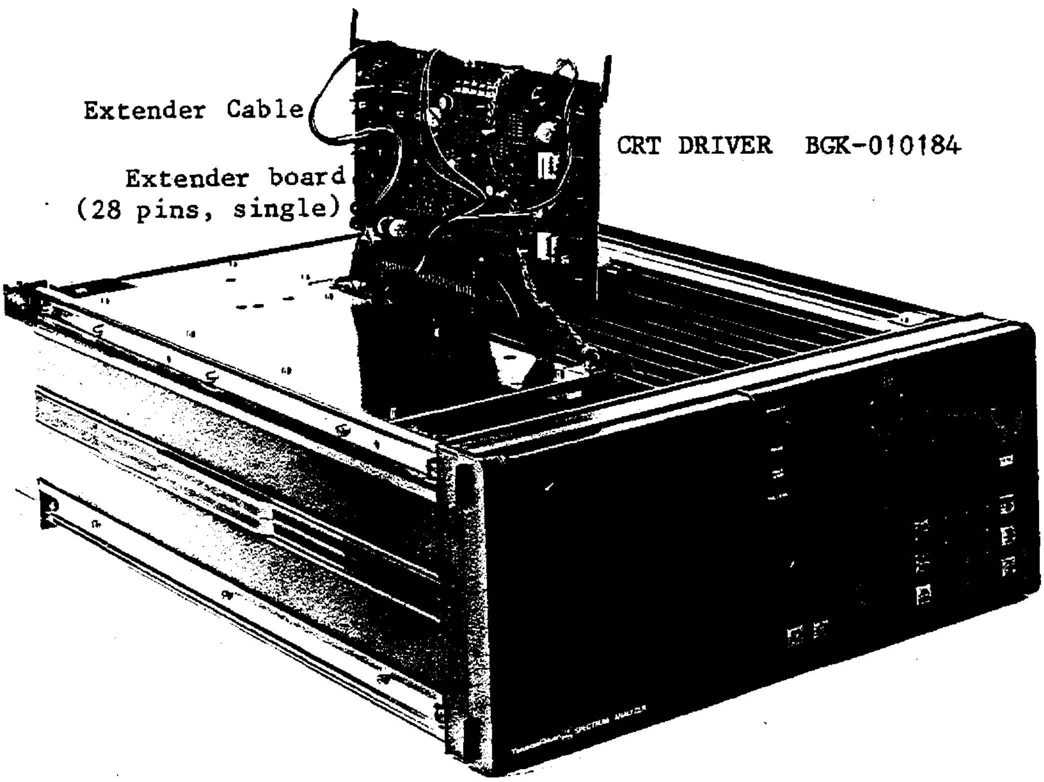


Fig. 11-6 Adjusting setup using an extender board

(2) Check the voltages at pins 1 and 5 of on-board connector J182 with a digital voltmeter. Adjust R203 and R199 until the voltage at each pin is +75 V.

(3) Turn the INTENSITY control on the front panel of the display section completely clockwise to obtain maximum display intensity. Adjust R202 so the display is not subject to halation due to secondary electron radiation.

(4) Adjust R200 until pattern distortion is minimized.

(5) Place the standard pattern scale (included in the maintenance kit) on the display screen, and adjust the display gain and position. The gain and position adjustments for the axis are R193 and R192 respectively, and those for the X axis are R195 and R194 respectively.

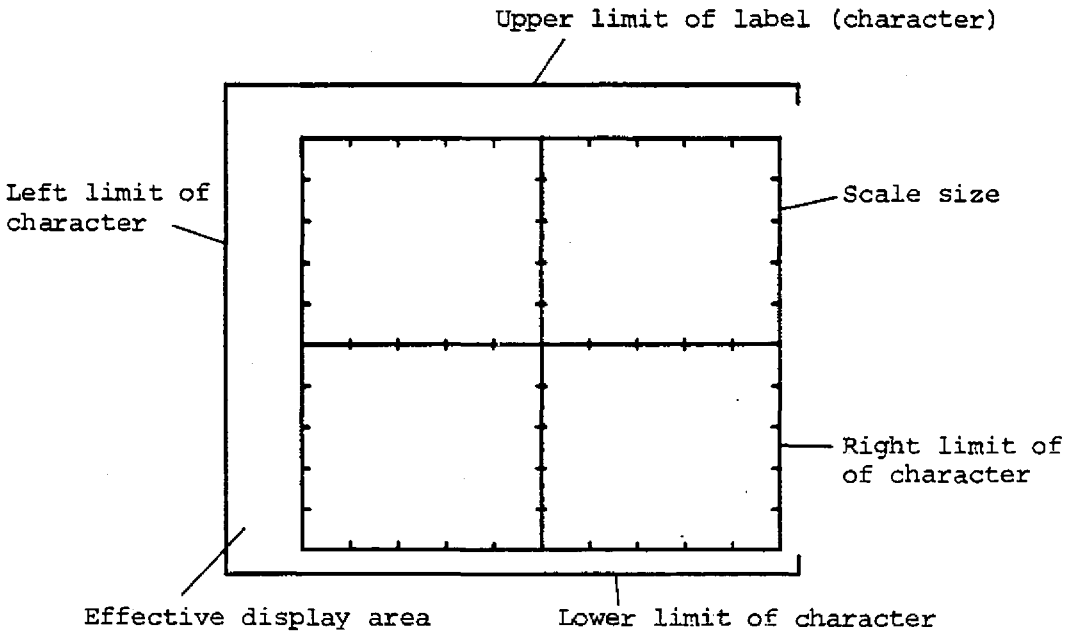


Fig. 11-7 Standard display scale (MPH-20803A)

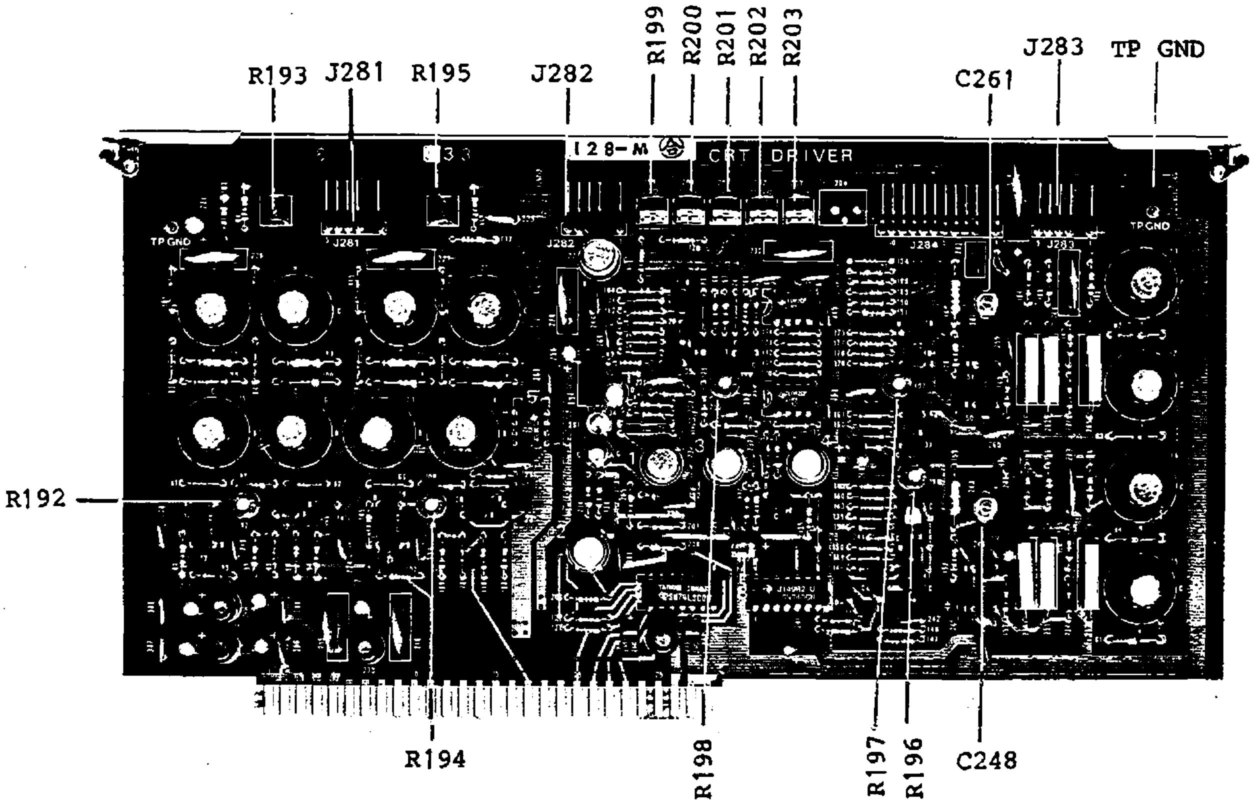
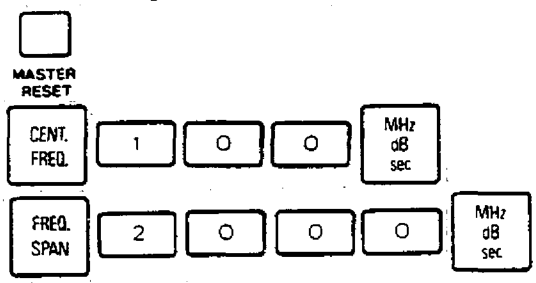


Fig. 11-8 Adjustment and test points on the CRT driver board (BGK-010184)

(6) Use the following key operations to obtain a signal response with steep transient:



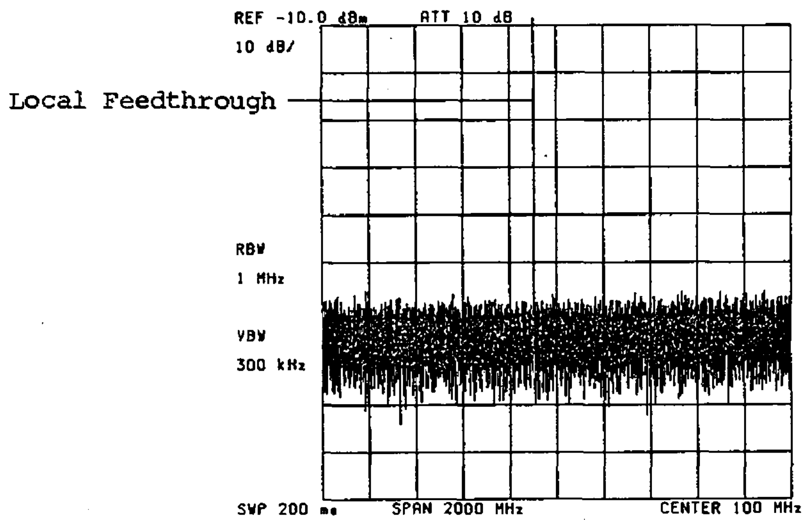


Fig. 11-9 Signal response display for intensity adjustment

(7) Set INTENSITY control on the front panel to the center position. Adjust R64 on the high voltage unit (MEP-0101204) and R196 on the CRT driver board (BGK-010184) until the signal response trace is slightly visible on the display. At this time, R64 should be turned toward low intensity, while T196 should be turned toward high intensity.

(8) Set the FOCUS screwdriver adjustment on the front display section to the center position. Adjust R63 on the high voltage unit and R201 on the CRT Driver board until the center of the display is well focused.

(9) Adjust R197 on the CRT Driver board until a good focus is obtained for the local feedthrough on the display.

(10) Adjust R198 so a good focus is obtained for the left and right areas of the display.

(11) While observing the signal at pin 1 of J283, adjust C248 until the waveform has no overshoot. Similarly, adjust C261 until the waveform at pin 3 of J283 has no overshoot. Connect the probe ground for the oscilloscope to a TP-GND on the board.

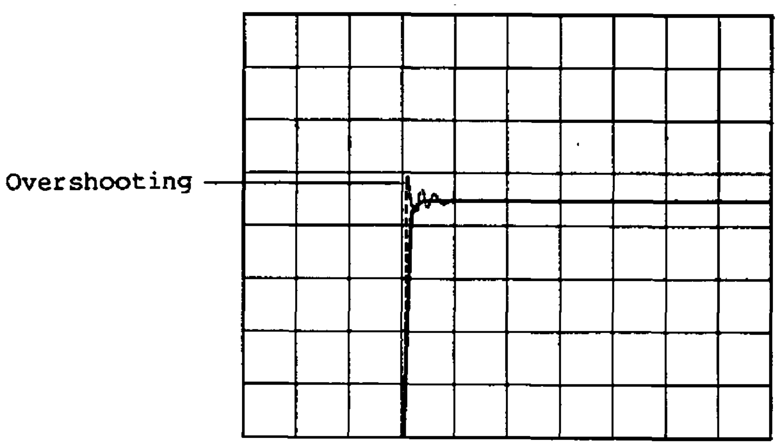


Fig. 11-10 Overshoot

(12) Set the POWER switch to STANDBY. Return the CRT Driver board (BGK-010184) into its original slot. Set the POWER switch to ON.

11-5-4. Data knob adjustment (Board: BGP-010192)
(Circuit diagram Nos. 21, 22)

Required instrument: Oscilloscope

(1) Using the oscilloscope, check the signals at TP2 and TP4 on the Memory board (BGP-010192).

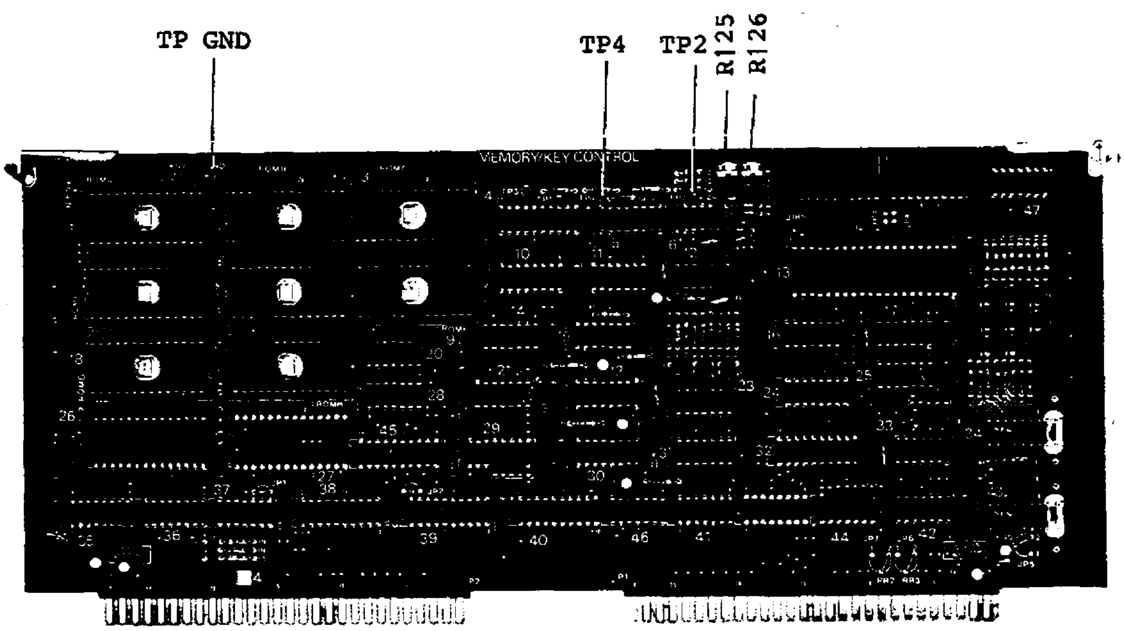


Fig. 11-11 Locations of Memory board (BGP-010192) check points

(2) Turn the front DATA knob at a constant speed, and adjust R125 and R126 until the signal waveforms at TP2 and TP4 have a duty ratio of 1:1.

11-5-5. D-A converter +10 V adjustment (Board: BGP-010188)

(Circuit diagram No. 14)

Instrument required: Digital voltmeter

(1) Set the POWER switch to STANDBY. Pull out the D-A Converter board (BGP-010188), then remount it in the same slot using an extender board (double 28 pins).

(2) Set the POWER switch to ON. Check the emitter voltage of Q61 on the board with a digital voltmeter. Adjust the collector voltage to +10 V ± 10 mV with R91.

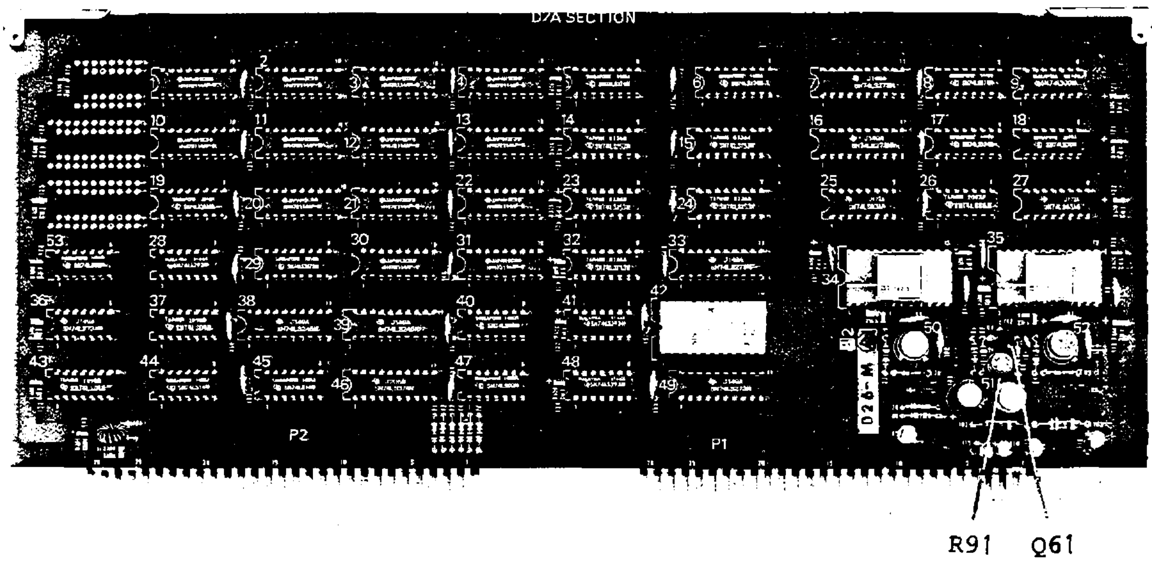


Fig. 11-12 Adjustment on the D-A converter board (BGP-010188)

(3) Set the POWER switch to STANDBY, and return the board to its original slot (without extender board). Then set the POWER switch again to ON.

11-5-6. Ramp Generator Adjustment (Board: BGP-010185)

(Circuit diagram No. 11)

Instrument required: * Digital voltmeter

* Function generator

* Oscilloscope

(1) Set the POWER switch to STANDBY. Pull out the ramp generator board (BGP-010185), then remount it in the same slot using an extender board (double 28 pins).

(2) Set the POWER switch to ON. Connect the oscilloscope to the card-edge connector pin P1-9AB (RAMP OUT), and adjust R95 until the output ramp signal has a 0 V ±5 V amplitude.

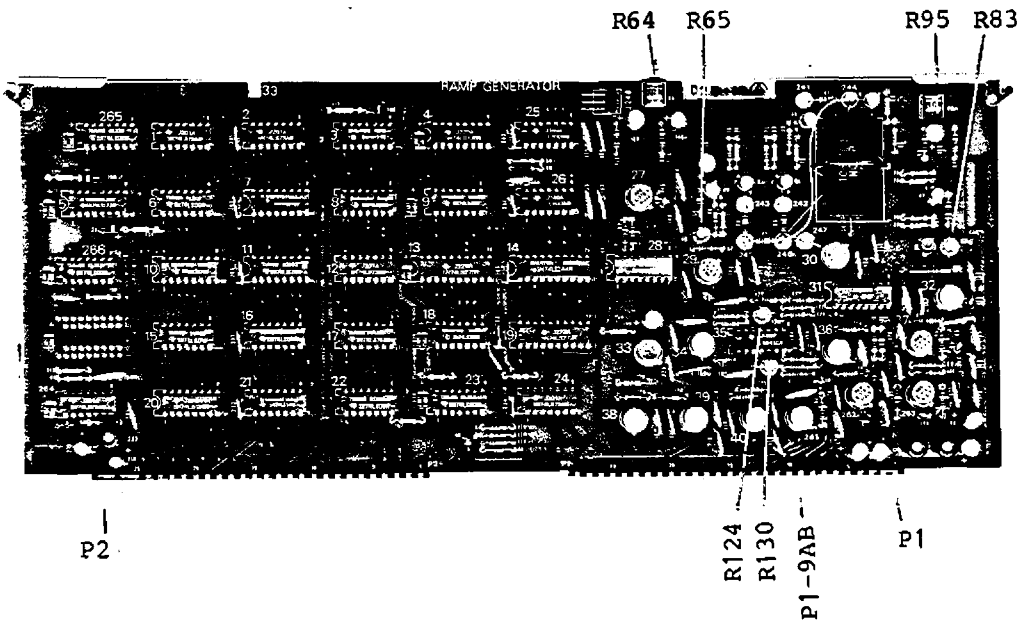


Fig. 11-13 Adjustments on the ramp generator board (BGP-010185)

(3) Set the POWER switch to STANDBY. Pull out the Analog I/O board (BGP-010186), and remove the jumper wire from JP1. Connect the function generator output to the LOG test point.

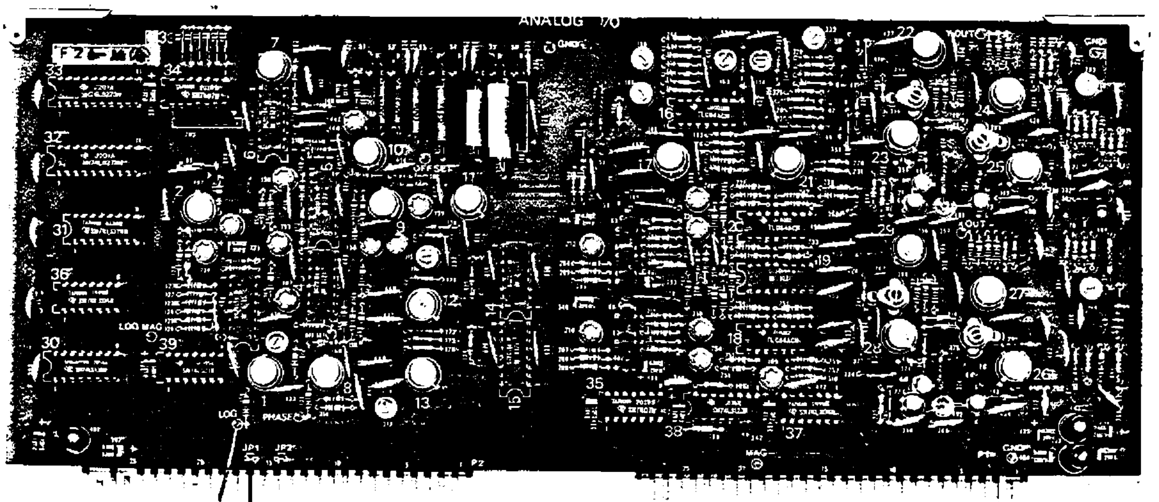
(4) Remount the analog I/O board in its original slot, then set the POWER switch to ON.

(5) Set the function generator output to 500 Hz, +2 Vp-p in level, and sinewave. Set the sweep time of the analyzer to 20 ms. Adjust R64 on the ramp generator board so that 10 cycles of sine wave exist within the scale span on the screen.

(6) Set sweep time to 2 sec. Set the function generator output frequency to 5 Hz. Adjust R65 on the Ramp Generator board (BGP-010185) so 10 cycles of sine wave appear within the scale span on the screen.

(7) Press SHIFT ZERO SPAN to select zero frequency span. Set sweep time to 500 [sec. Set the function generator output frequency to 20 kHz. Adjust R83 so that 10 cycles of sine wave appear within the scale span on the display.

(8) When R64 is readjusted, also readjust R65 and R83.



Analog I/O (BGP-010186)

Fig. 11-14 Connecting a function generator output to the analog I/O board

(9) Adjust analog sweep. Set the output frequency of the function generator to 100 Hz. Set sweep time to 19 ms. Adjust R124 until the signal response on the display is centered on the vertical center scale.

(10) Adjust rewriting position. Set sweep time to 10 sec. Adjust R130 until the trace rewriting position coincides with the blanking position at the center of the screen.

(11) Set the POWER switch to STANDBY. Disconnect the function generator output from the analog I/O board, and install the jumper wire at JP1. Return the analog I/O and ramp generator boards to their original slots, then set the POWER switch to ON again.

11-5-7. Analog I/O Board Adjustment (Board No. BGP-010186)
(Circuit diagram No. 12)

Instrument required: * Digital voltmeter (4 and a half digits.)
* Standard DC voltage source
* Function generator

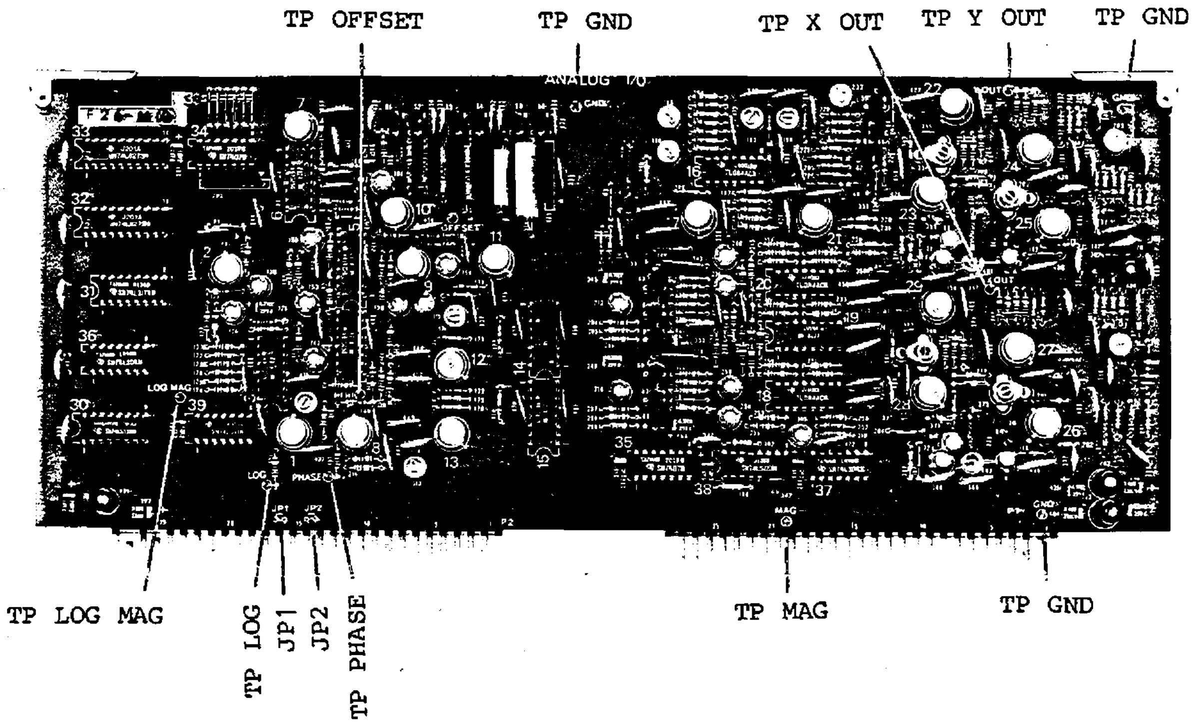


Fig. 11-15 Locations of adjustments and test points on the analog I/O board (BGP-010186)

(1) Set the POWER switch to STANDBY. Pull out the Analog I/O board (BGP-010186), and remove jumper wires from JP1 and JP2. Remount the board in the same slot using an extension card (double 28 pins).

(2) Connect the output of a standard DC source across the LOG test point and a GND test point. Set the voltage source output to 0.000 V, then set the POWER switch to ON.

(1) Adjusting the MAG. amplifier for logarithmic display

(a) Check the voltage across the test point log mag and a GND test point with a digital voltmeter. Press SHIFT, 1dB/DIV. to set the vertical scale to 1 dB/div. Adjust R311 until the voltmeter reading (offset voltage of the first operation amp.) is less than 50 μV.

(b) Press SHIFT, 10dB/DIV. to set the vertical to 10 dB/div. Check the voltage across the test point MAG and GND (test point). Set standard DC output to 2.5 V. Adjust R134 until the voltage is 2.5 V ±5 mV.

(c) Set standard DC output to 0.000 V. Adjust R130 until the voltmeter reading is 5.000 V ±5 mV.

(d) Repeat steps (b) and (c) several times.

(2) Adjusting the MAG. amplifier for phase display

(a) Set the output of standard DC to 0.000 V. Disconnect it from the log test point and reconnect it to the phase test point.

(b) Press [MASTER RESET], [FREQ. SPAN] [1] [0] [MHz dB sec] and [GROUP DELAY], then use the DATA knob to set the vertical scale to 20 ns/div. Check the voltage across the offset test point and GND (test point) (offset voltage of the first operation amp.). Adjust R315 until the offset voltage is less than 50 μV.

(c) Check the voltage at the test point MAG to GND. Adjust R164 until the voltage is +2.500 V ±5 mV.

(d) Set the standard DC output to +400 mV, and adjust R158 until the voltmeter reads +5.100 V ±5 mV.

(e) Set the output of standard DC to −400 mV, and verify that the voltmeter reading is −0.100 V ±5 mV.

(f) Press [PHASE] to select 8°/div. Set the standard DC output to +400 mV. Adjust R156 until the voltmeter reads +4.750 V ±5 mV.

(g) Use the DATA knob to select 20°/div. Set the standard DC output to +1.000 V. Adjust R147 until the voltmeter reads +4.750 V ± 5 mV.

(h) Use the DATA knob to select 40°/div. Set the standard DC output to +2.000 V. Adjust R150 until the voltmeter reads +4.750 V $\pm$5 mV.

(i) Use the DATA knob to select 80°/div. Adjust R153 until the voltmeter reads +3.625 V $\pm$5 mV.

(3) Scale position adjustment

(a) Adjust R183 so the bottom end of the vertical scale is aligned to the bottom graticule of the horizontal scale.

(b) Adjust R190 until the left end of the horizontal scale is aligned to the leftmost graticule of the vertical scale.

(c) Adjust R180 until the top end of the vertical scale is aligned to the top graticule of the horizontal scale.

(d) Adjust R188 until the right end of the horizontal scale is aligned to the rightmost graticule of the vertical scale.

(4) Character size and position adjustment

(a) Place the standard pattern scale shown in Figure 11-7 (used for x-and y-axis adjustment) on the display screen.

(b) Make the following adjustments until each character location is aligned to the standard pattern scale:
R236 for character position on the y-axis.
R240 for y-axis gain.
R256 for character position on the X-axis.
R254 for x-axis gain.

(5) Line generator adjustment

(a) Disconnect standard DC output from PHASE and GND test points, to which it was connected during the adjustment of the MAG. amplifier for phase measurement. Connect the function generator across LOG and GND test points.

(b) Press [MASTER RESET], [SWEEP TIME] [1] [•] [5] [MHz dB sec] to set sweep time to 1.5 s. Set the function generator output to 500 Hz, 2 Vp-p, with DC offset of 1.3 V.

(c) Press [A] (VIEW), [ ] (MARKER), and turn the DATA knob slightly. The marker will move vertically. Adjust C354 so the marker traces the signal response on the display.

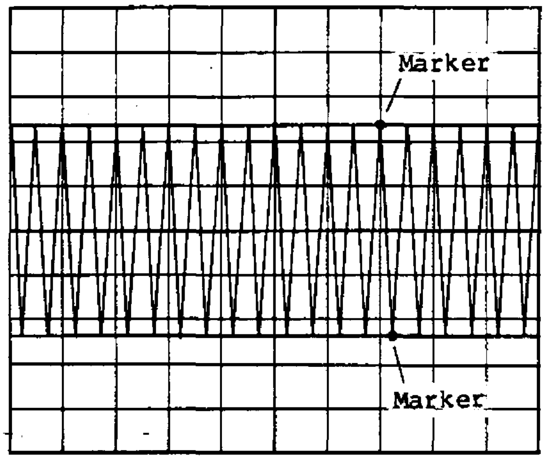
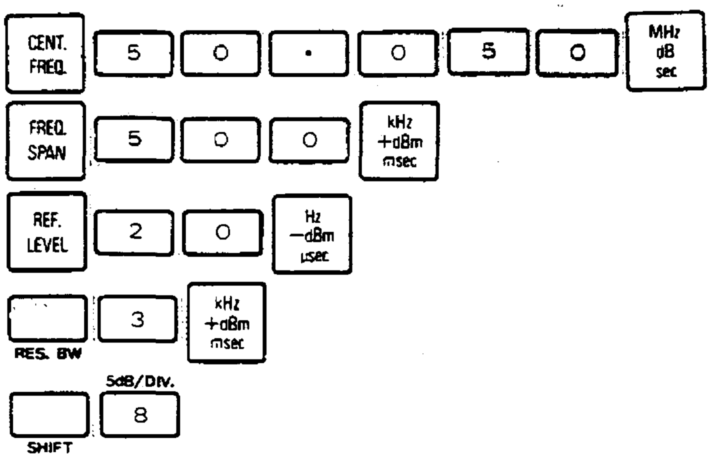


Fig. 11-16 Marker level adjustment

(d) Disconnect the function generator from the LOG and GND terminals, and set the POWER switch to STANDBY. Install jumper wires on JP1 and JP2, then switch the analyzer on again.

(e) While the instrument is in the initial default state, prepare it as follows:



(f) Connect the CAL. OUT. connector to the INPUT-1 connector to display the CAL. OUT. signal response. Adjust C375 until a smooth and straight response trace is obtained.

Adjust so the signal response
is smooth and free of ripples.

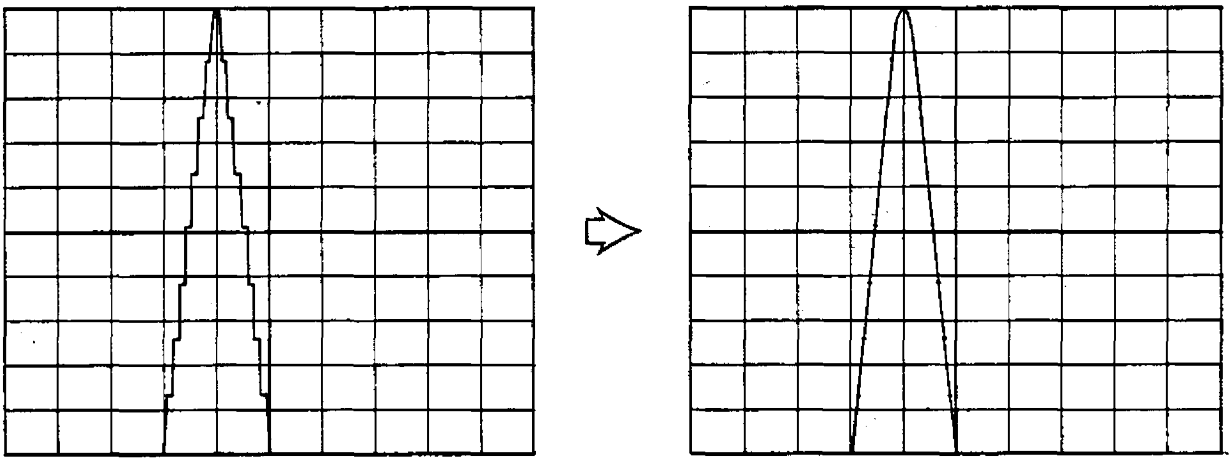
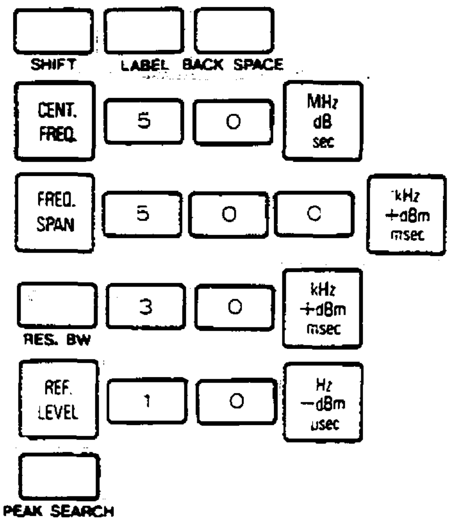


Fig. 11-17 Line generator adjustment 1

(g) Update the panel setup on the instrument as follows:



(h) Adjust the CAL control on the front panel of the analyzer until the level readout identified by the marker is exactly -20.0 dBm.

(i) Press MKR OFF, and adjust C363 until the signal response peak is positioned on the horizontal scale at -20 dBm.

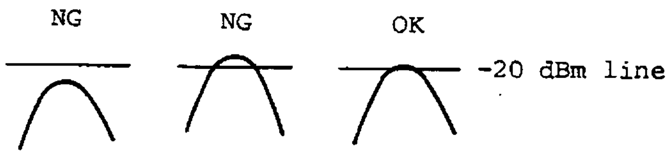


Fig. 11-18 C363 adjustment

(j) Adjust line generator in the graphic mode (S parameter display). Disconnect the CAL. OUT. from the INPUT-1 connector. Press [MASTER RESET] [SHIFT] [LABEL] [O] to select the S parameter display mode. Adjust C366 until a smooth circumference line (for a Smith chart, for example) is obtained. Then adjust the horizontal position of the Smith chart with R309 until the center position of Smith chart is aligned to the center graticule of the vertical scale.

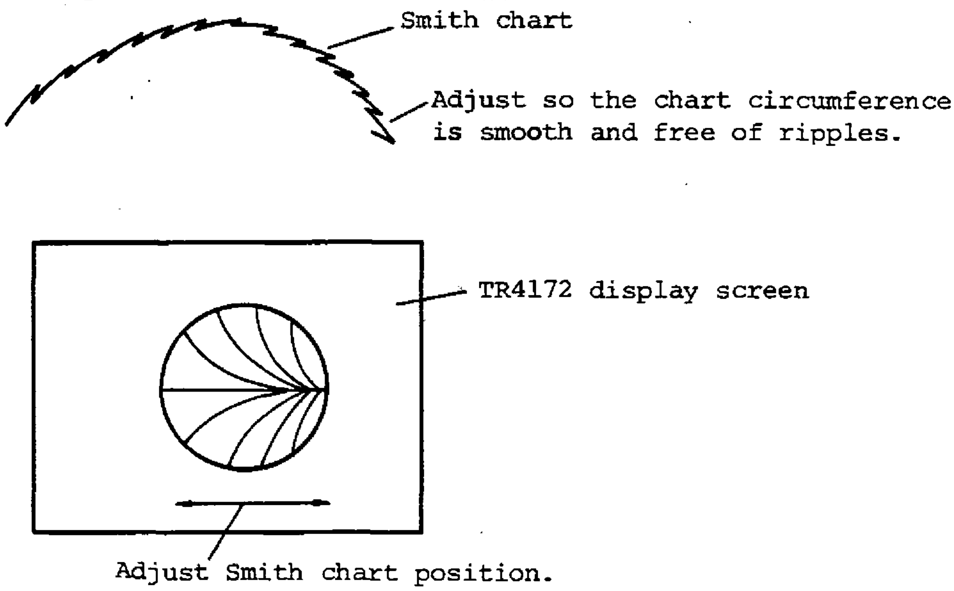


Fig. 11-19 Line generator adjustment (position)

(6) Marker size adjustment

Press [MARKER] to activate the marker. Adjust R293 and R306 until a round marker dot is obtained.

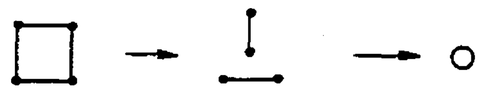


Fig. 11-20 Marker adjustment

(7) Analog sweep positional adjustment

(a) Press [SHIFT] [ZERO SPAN ⇧] to select zero frequency span. Press [SWEEP TIME ▭] [2] [0] [kHz +dBm msec], then use [⇩] to set sweep time to 10 ms.

(b) Analog sweep mode is selected instead of digital sweep mode when the step down switch is pressed. The signal response trace will be verticary displaced slightly when the sweep mode is switched from digital to analog. Adjust R174 until the trace is repositioned to its original position.

(c) Set the POWER switch to STANDBY. Mount the analog I/O board in its original slot (without extension card), then switch on the instrument again.

11-5-8. A-D Converter Board Adjustment (Board: BGP-010187)

(Circuit diagram No. 13)

Instruments required: * Digital voltmeter (4 and a half digits.)
* Standard DC voltage source
* Function generator

(1) Set the POWER switch to STANDBY. Pull out the A-D Converter board (BGP-010187), and remove the jumper wire from JP1. Remount the board in the same slot using an extension card (double 28 pins).

(2) Connect the standard DC output across the test points TP1 and GND. Set standard DC output to 5.000 V, then set the POWER to ON.

(3) Use the digital voltmeter to check the voltage across test points TP4 and GND. Set sweep time to 10 sec.

(4) Press [SHIFT] [SAMPLE D.] z to select sample detection mode. Adjust R177 until the voltage at TP-4 is +5.000 V ±1 mV.

(5) Press [SHIFT] [POSIT. PEAK D.] p to select positive peak detection mode. Adjust R178 until the voltage at TP-4 is +5.000 V ±1 mV.

(6) Press [SHIFT] [NEG. PEAK D.] s to select negative peak detection mode. Adjust R176 until the voltage at TP-4 is +5.000 V ±1 mV.

(7) Set the standard DC output to 0.000 V. Set the reference level to 0 dBm. Press MARKER, and adjust R179 until the marker reading is -100.0 dBm ±1.0 dBm.

(8) Set standard DC output to +5.000 V. Adjust R180 until the marker reading is 0.0 dBm +0.1 dBm. Repeat steps (7) and (8) several since R179 and R180 affect each other.

(9) Disconnect standard DC from test points TP-1 and GND and instead connect the function generator output across TP-1 and GND. Set the function generator output to 100 Hz per 100 Hz triangular wave 2 Vp-p, output level, and 1.3 V DC offset.

(10) Connect oscilloscope across pin 9 of IC10 and GND, and adjust R175 until obserbed signal waveform stops flickering.

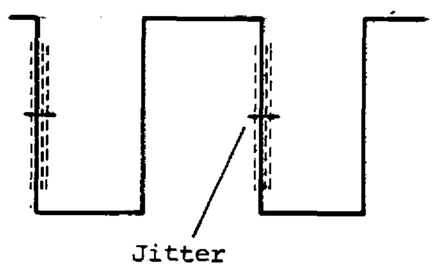
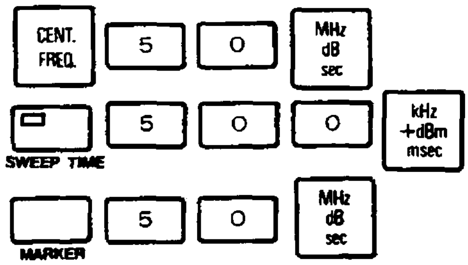


Fig. 11-21 Adjusting R175 on the A-D converter board

(11) X-axis center adjustment. Set POWER switch to STANDBY, and return the JP1 jumper wire. Set the POWER switch to ON again, the update the panel setup as follows:



Connect the CAL. OUT. signal to the INPUT-1 connector.

(12) Adjust R181 so the marker is positioned to the peak of the 50 MHz signal response.

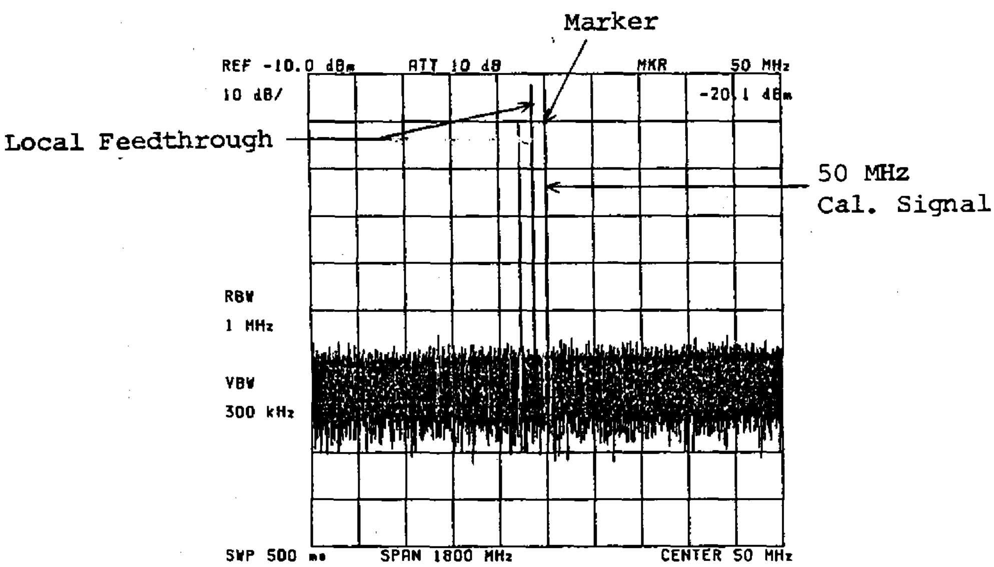


Fig. 11-22 X-axis center adjustment

(13) Set the POWER switch to STANDBY, and return the board to its original slot (without extender board). Reset the POWER switch to ON.

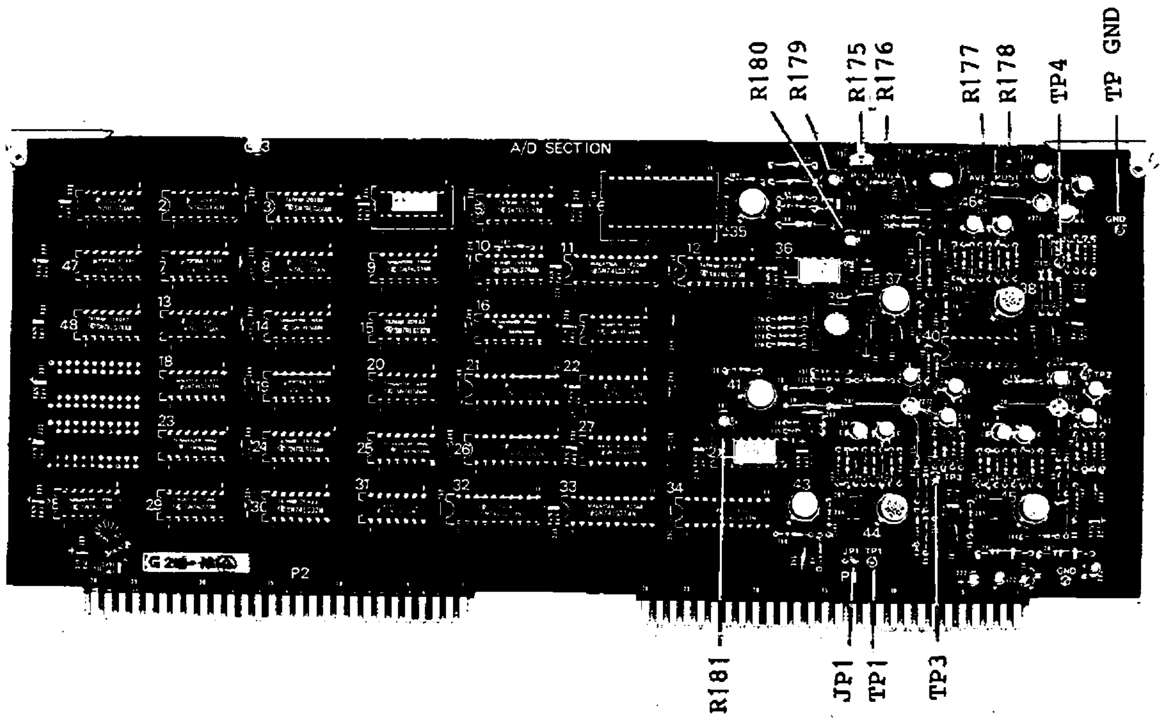


Fig. 11-23 Locations of adjustments and test points on the A-D Converter (BGP-010187) board

11-5-9. Log Amp. Adjustment (Board: BLP-010231) MEP-337
(Circuit Diagram No. 30) (Parts Allocation No. 24)

Instruments required:
* Digital voltmeter (four and a half digits)
* Signal generator
* Spectrum analyzer (with tracking generator)
* High-impedance probe
* Attenuator covering 0 to 100 dB in 10-dB steps

(1) Log. amplifier 3.33 MHz tuning

(a) Set the POWER switch to ON and warm up the instrument for at least 10 minutes. Connect the tracking generator output of the second spectrum analyzer to the LOG IN terminal on the LOG AMP board. Set the tracking generator output to -40 dBm. Remove the shield case over from the LOG AMP unit. Using the second spectrum analyzer with a high impedance probe attached to its input, observe the signal appearing on the board across R152 and GND.

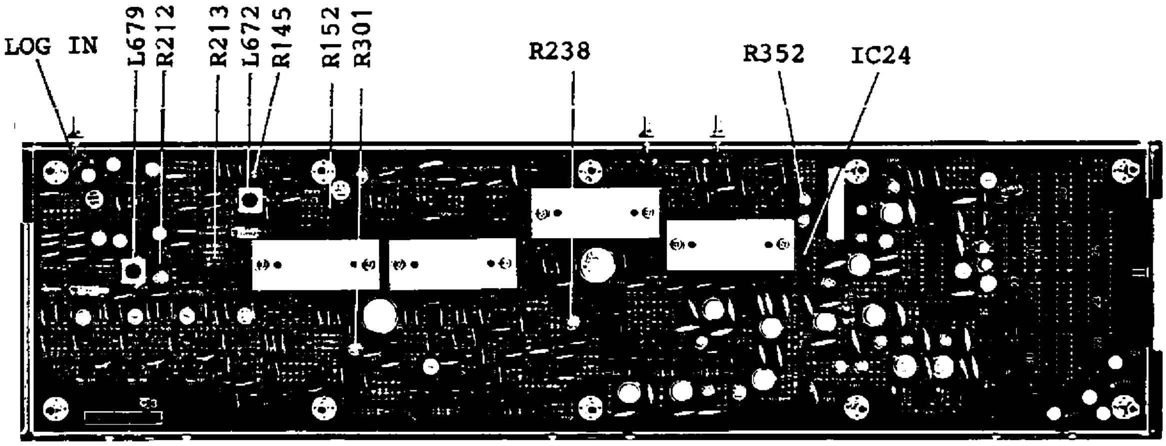


Fig. 11-24 LOG AMP 3.33 MHz tuning

(b) Set resolution bandwidth to 100 kHz. Adjust L672 until the signal response peak on the second spectrum analyzer is 3.333 MHz.

(c) Press [RES. BW] [⇧] to set resolution bandwidth to 300 kHz. Use the observed signal response peak as a reference. Press [⇩] to reduce resolution bandwidth to 100 kHz, and adjust R145 until the signal response peak comes to the reference level (within ± 0.1 dB).

(d) Set the tracking generator output connected to the LOG IN terminal) to -10 dB. Set resolution bandwidth to 100 kHz. Connect the second spectrum analyzer to R213. Adjust L679 until the peak signal response observed on the second analyzer is positioned at 3.333 MHz.

(e) Press [RES. BW] [⇧] to increase resolution bandwidth to 300 kHz. Then reduce it to 100 kHz, adjusting R212 until the peak level matches the peak level obtained at a 300 kHz resolution bandwidth (within ± 0.1 dB).

(2) LOG AMP gain and offset adjustment

(a) Connect a signal generator output to the LOG IN terminal using an external attenuator. Set the S.G. output to 3.333 MHz in frequency and 0 ±0.1 dBm in level. Check the voltage at pin 3 or 14 of IC 24 (to GND) with a digital voltmeter. Set resolution bandwidth to 100 kHz.

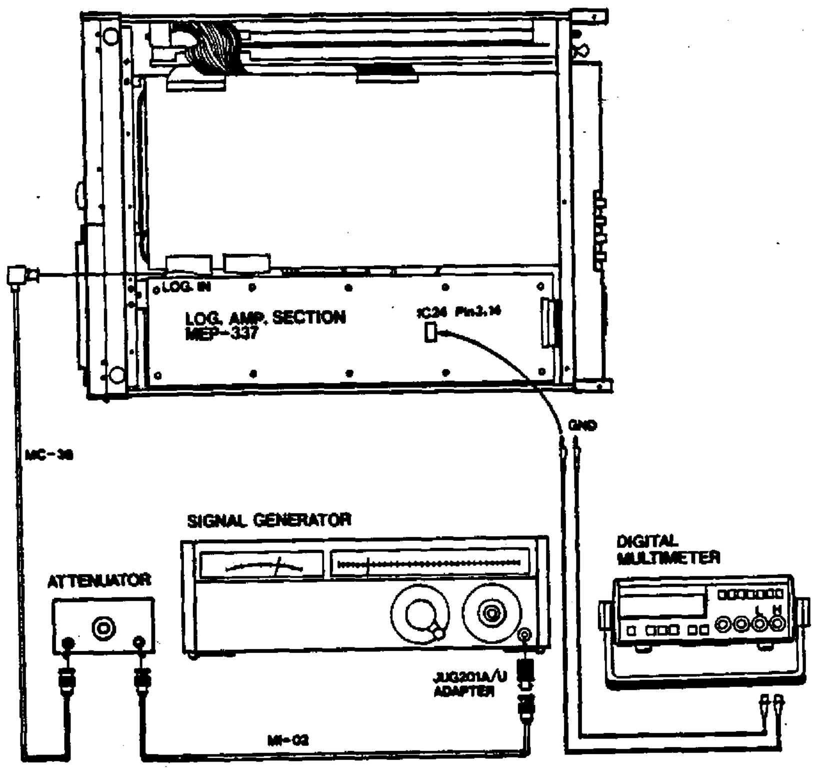


Fig. 11-25 LOG AMP gain adjustment

(b) While changing the external attenuator setting from 60 to 90 dB in 10dB steps, adjust R238 so the LOG AMP OUT voltage (at pin 3 or 4 of IC 24) changes at 0.500 V ±5 mV steps.

(c) While changing the external attenuator setting from 0 to 40 dB in 10dB steps, adjust R301 so the LOG AMP OUT voltage changes at 0.500 V ±5 mV steps.

(d) Set the external attenuator to 0 dB, and adjust R355 until the LOG AMP OUT voltage is 0.000 V ±5 mV.

(e) Set the external attenuator to 60 dB, and adjust R157 until the LOG AMP OUT voltage is 3.000 V ±5 mV. Repeat several times since R355 and R157 affect each other.

(3) Reference level and DC offset adjustment

Press [REF. LEVEL] [1] [0] [0] [Hz −dBm μsec] to minimize the reference level (the actual reference leve should be positioned at −90 dBm). Set the external attenuator to 60 dB, and adjust R335 until the LOG AMP OUT voltage is +1.000 V ±5 mV.

(4) Gain, offset, and step amplifier adjustment in LIN. mode

(a) Press [REF. LEVEL] [0] [kHz +dBm msec] and [SHIFT] [1 (LIN. X1)], and adjust R355 until the LOG AMP OUT voltage is +5.000 V ±5 mV. Then set the external attenuator to 0 dB, and adjust R294 until the voltage is 0.000 V ±5 mV.

(b) Set the external attenuator to 10 dB. Set the analyzer reference level to −50 dBm, and adjust R254 until the voltage is 0.000 V ±10 mV. Refer to the following table when adjusting the step amplifier in the LIN. mode.

Table 11-4 Step amplifier adjustment in LIN mode

AMP. GAIN	REF. LEVEL	External attenuator	Output voltage	Adjustment
10 dB	−50 dBm	10 dB	0.000 V ±10 mV	R254
20 dB	−60 dBm	20 dB	Same as above	R263
30 dB	−70 dBm	30 dB	Same as above	R254, R263
40 dB	−80 dBm	40 dB	Same as above	R272
50 dB	−90 dBm	50 dB	Same as above	R254, R263, R272

(c) Repeat the adjustment steps several times in the amplifier gain range of 10 to 50 dB as R254, R263, and R272 slightly affect each other.

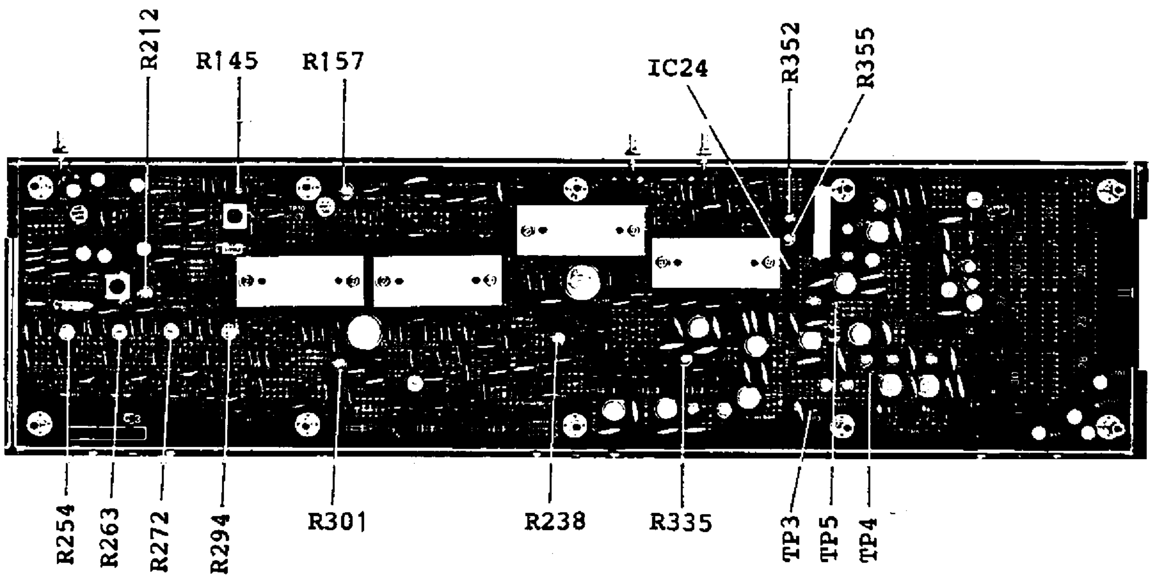


Fig. 11-26 Location of adjustments on the LOG AMP board (BLP-010231)

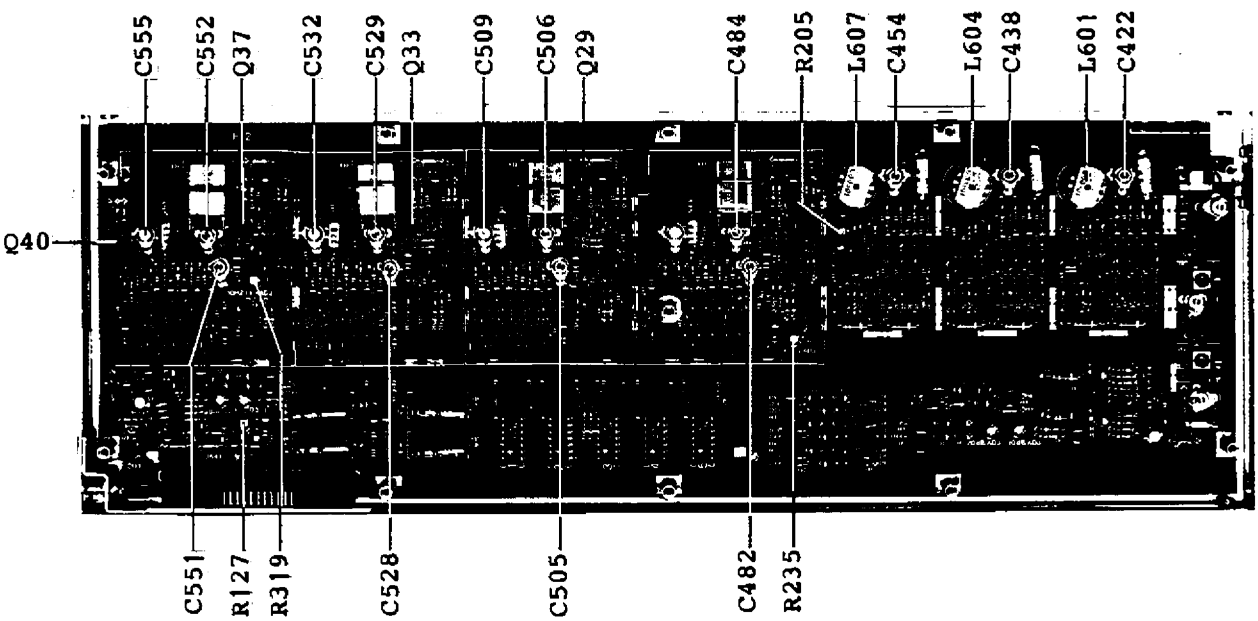


Fig. 11-27 (1) Location of adjustments on the IF1 board (BLP-010229)

11-5-10. IF Filter Adjustment (MEP-338)

(Board and circuit diagram Nos.
IF-1 BLP-010229, Nos. 25, 26
IF-2 BLP-010230, Nos. 27, 28, 29)

Instruments required:
* Spectrum analyzer with tracking generator
* High impedance probe
* Function generator (time base frequency accuracy 10^{-8})
* External attenuator (0-100 dB in 10 dB steps) (0-10 dB in 1 dB steps)

(1) Set the POWER switch to STANDBY. Remove the IF FILTER block (MEP338) from the chassis. Set the POWER switch to ON again.

(2) Connect the tracking generator output of the external spectrum analyzer to the IF-1 input on the IF block. Set the tracking generator output level at about -20 dBm. Connect the output of the IF-1 block to the input of the external spectrum analyzer.

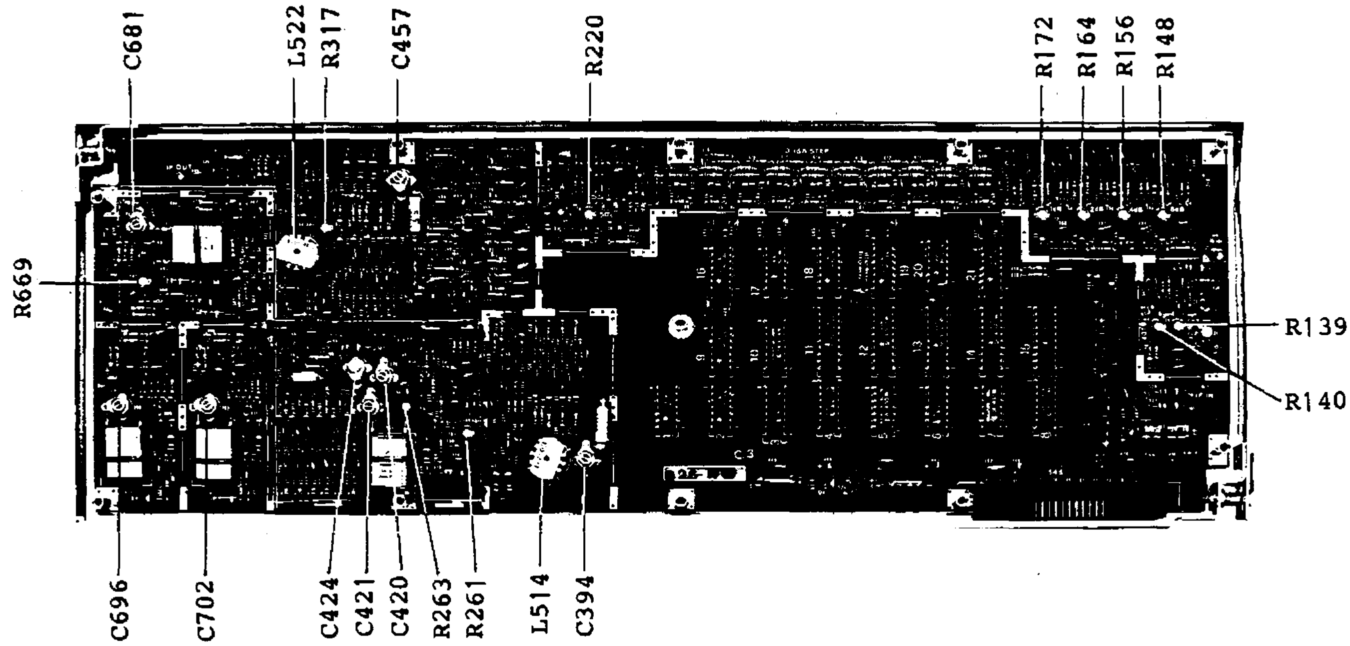


Fig. 11-27 (2) Location of adjustments on the IF2 board (BLP-010230)

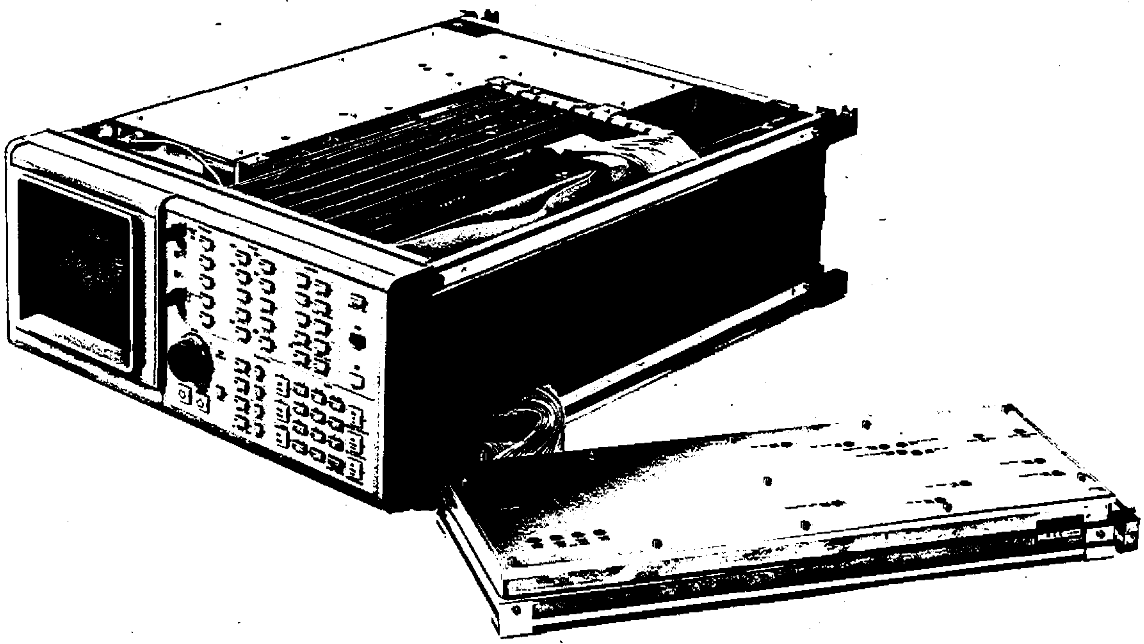


Fig. 11-27 (3) IF section adjustment

(1) IF-1 1 MHz BPF adjustment

Set the reference level to -50 dBm. Unless specified, leave the reference level at this value. Set resolution bandwidth to 1 MHz. Set the center frequency of the second spectrum analyzer to 3.333 MHz and observe the response of the 1 MHz band-pass filter (BPF) in the IF-1 block. Adjust L591, L592, L593 and L594, L595 until the following BPF response is obtained:

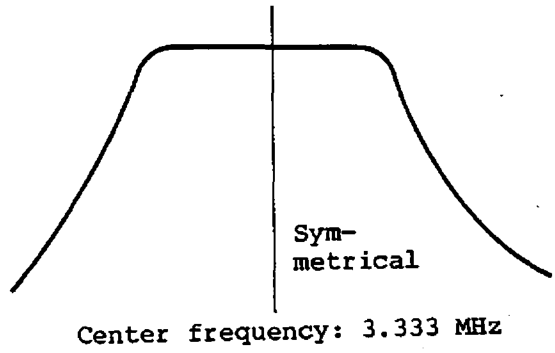


Fig. 11-28 1 MHz BPF response in IF-1 block

(2) IF-1 block LC filter adjustment

(a) Increase the resolution bandwidth to 10 kHz. Connect the function generator output to the IF-1 block input, instead of the tracking generator output. Set up the function generator output for 3.333333 MHz sine wave and -20 dBm output level.

(b) Observe the output of the IF-1 block with the second spectrum analyzer. The center frequency of the analyzer should be set at 3.333 MHz. Adjust L601 and C422 (first filter), L604, and C438 (second filter), and L607 and C454 (third filter) until the output signal level is maximized.

(3) IF-1 quartz filter adjustment

(a) Reduce the resolution bandwidth to 10 Hz. With the function generator set up, observe the output of the IF-1 block using the second spectrum analyzer. Adjust C484, C506, C529, and C552 until the output level is maximized.

(b) Connect the tracking generator output of the second spectrum analyzer to the input of the IF-1 block, instead of the function generator output. Set the T.G. output level to about -20 dBm. Remove the shield case cover from the IF-1 block. Set the resolution bandwidth to 3 kHz.

(c) Using the high-impedance probe attached to the input of the second spectrum analyzer, observe the signal response at the Q29 emitter (input of X632) using the analyzer. Adjust C482 until the signal response observed on the analyzer is centered. Adjust C486 until the frequency at the signal response peak is 3.33333 MHz.

(d) Observe the signal response at the Q33 emitter (input of X633) using the spectrum analyzer. Adjust C505 so the signal response on the screen is centered. Adjust C509 until the frequency at the signal response peak is 3.33333 MHz.

(e) Next, observe the signal response at the Q37 emitter (input of X634) using the analyzer. Adjust C528 for waveform balance and C532 for frequency.

(f) Observe the signal response at the Q40 collector. Adjust C551 for waveform balance and C555 for frequency.

(g) Remount the shield case cover on the IF-1 block.

(4) IF-2 block LC filter adjustment

(a) Connect the output of the IF-1 block to the input of the IF-2 block. Connect the function generator output to the input of the IF-1 block. Set up the function generator output for a sine wave with the frequency of 3.333333 MHz and output level of -20 dBm.

(b) Set the resolution bandwidth to 10 kHz. Observe the output of the IF-2 block with the second spectrum analyzer. The center frequency of the analyzer should be set at 3.333 MHz. Adjust L514 and C394 (first filter) and L522 and C457 (second filter) until the output level is maximized.

(5) IF-2 block crystal filter adjustment

(a) Reduce the resolution bandwidth to 10 Hz. Adjust C421 until the output level is maximized.

(b) Connect the tracking generator output of the second spectrum analyzer to the input of the IF-1 block, instead of the function generator output. Set the T.G. output level at around -20 dBm. Set the resolution bandwidth to 3 kHz.

(c) Observe the output of the IF-2 block with the second spectrum analyzer. Adjust C420 until the filter response is symmetrical. Adjust C424 until the frequency at the signal response peak is 3.33333 MHz.

(6) IF-2 block crystal filter 7 Hz adjustment

(a) Press [SHIFT] [LABEL] [POSIT. PEAK D. / AUTO] P to set the resolution bandwidth to 7 Hz. Apply the function generator output to the input of the IF-1 block. Set up the function generator output for a sine 3.333333 MHz sine wave and -20 dBm output level.

(b) Connect the spectrum analyzer to the output of the IF-2 block, and adjust C702, C696, and C681 until the maximum output signal level is attained.

(c) Mount the shield case cover on the IF-2 block.

(7) IF 10 dB Step Amplifier adjustment

(a) Press [SHIFT] [LABEL] [BACK SPACE] to clear the correction value setup for the Error Correction Routine. Apply the tracking generator output of the second spectrum analyzer to the input to of IF-1 block via external attenuators (with 10 dB and 1 dB steps in series). Set the T.G. output level at around -10 dBm. Connect the spectrum analyzer to the output of the IF-2 block to observe its output signal response.

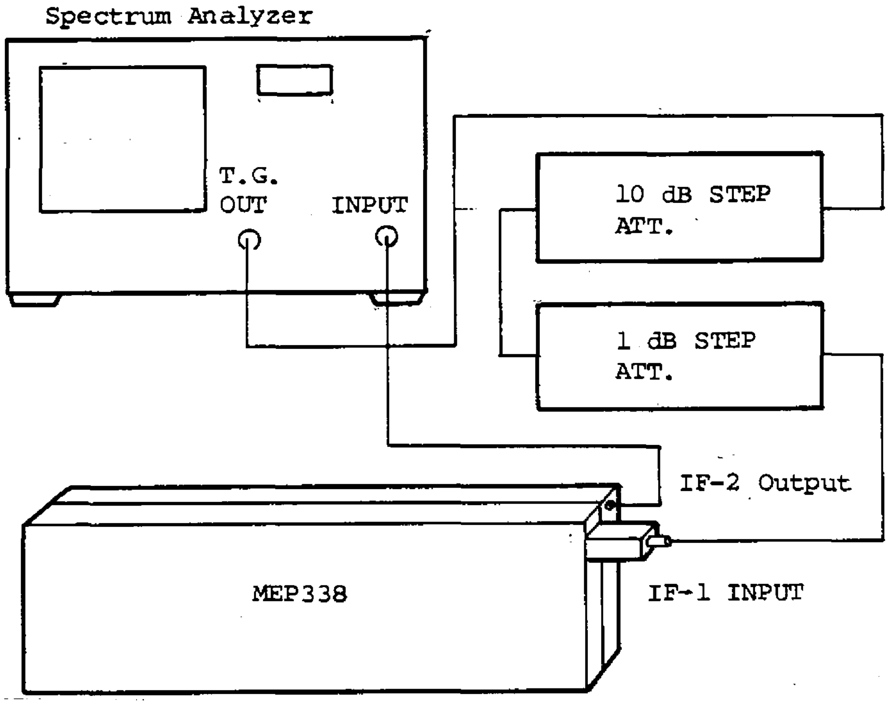


Fig. 11-29 Step amplifier adjustment

(b) Set both attenuators to 0 dB, and update the panel setup for the TR4172 as follows:

[RES. BW] [3] [0] [0] [kHz +dBm msec]

[SHIFT] [LABEL] [SIGNAL TRACK]

(IF step amplifier check 10 dB mode)

(c) Pressing [0] will select STEP AMP gain of 0 dB, and pressing [1] will select STEP AMP gain of 10 dB. During this mode, keys [0] to [5] select step amplifier gains from 0 dB to 50 dB respectively at 10 dB steps, however, the active function area readout does not change.

(d) Press 0 to set the step amplifier gain to 0 dB, and note the peak level of the observed signal response on the spectrum analyzer. While referring to the table below, adjust each trimmer resistor listed so the peak levels obtained at step amplifier gains of 10 dB 50 dB are within ±0.05 dB with respect to the peak level observed when the amplifier gain was 0 dB.

Table 11-5 IF step amplifier adjustment

IF STEP AMP GAIN	0 dB	10 dB	20 dB	30 dB	40 dB	50 dB
External attenuator	0 dB	10 dB	20 dB	30 dB	40 dB	50 dB
Location of adjustment		IF-1	IF-1	IF-2	IF-2	IF-2
No.		R136	R137	R139	R140	R220

(8) 1 dB step attenuator adjustment

(a) This adjustment should be performed by following the 10 dB step amplifier adjustment. In the IF Step Amp Check 10 dB mode, press 0 to set the step amplifier gain to 0 dB. Then press signal track to set the IF step attenuator to 1 dB. Operation of 0 through 9 will set the 1 dB step attenuator to 0-9 dB at 1 dB steps, respectively.

(b) Set the external attenuator (with 1 dB stepping) to 10 dB. Press 0 to select the 1dB step ATT to 0dB. Note the signal response peak level observed at that time on the analyzer. Referring to the following table, adjust each trimmer resistor listed so the signal response peaks are within ±0.05 dB with respect to the peak level observed when the 1 dB step attenuator was set at 0 dB.

Table 11-6

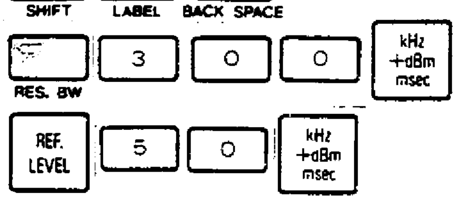
IF STEP ATT	0 dB	1 dB	2 dB	4 dB	8 dB
External attenuator	10 dB	9 dB	8 dB	6 dB	2 dB
Location of adjustment		IF-2	IF-2	IF-2	IF-2
No.		R172	R164	R156	R148

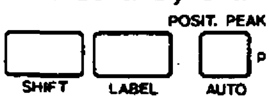
(9) Resolution bandwidth switching level accuracy adjustment

(a) Apply the output of the second spectrum analyzer tracking generator to the input of the IF-2 block, and observe the output of the IF-2 block with the same analyzer. Set the tracking generator output level to about -20 dBm.

(b) Set up the TR4172's panel as follows:

(Clears the error correction data)



(c) Referring to the peak output level obtained at a resolution bandwidth of 300 kHz, adjust R317, R261, R263, and R669 on the IF-2 block so the peak levels obtained at resolution bandwidths of 10 kHz, 3 kHz, 10 Hz, and 7 Hz (set up by operating 

) are within ±0.5 dB with respect to the reference level.

(d) Connect the tracking generator output to the input of the IF-1 block, and observe the output of the IF-1 block with the spectrum analyzer.

(e) Referring to the peak output level obtained at a resolution bandwidth of 300 kHz, adjust R205, R235, and R319 on the IF-1 block so the peak levels obtained at resolution bandwidths of 10 kHz, 3 kHz, and 10 Hz are within ±0.5 dB with respect to the reference level.

(10) Total level adjustment

(a) Apply the output of the second spectrum analyzer's tracking generator to the input of the IF-1 block, and observe the output of the IF-2 block. Connect the output of the IF-1 block to the input of the IF-2 block.

(b) Set up the TR4172's panel as in (9)-(b). Adjust R127 on the IF-1 block until the gain from the input of the IF-1 through the output of the IF-2 is +5 ±0.1 dB.

(c) Set the POWER switch to STANDBY. Return the IF Filter block to its original slot, then set the POWER switch to ON again.

11-5-11. Phase and G.D. Adjustment (Board No. BLP-010205) MEP-339 (Circuit diagram Nos. 31, 32)

Instrument required: * Digital voltmeter
* Spectrum analyzer with tracking generator
* High-impedance probe

(1) Reference voltage and null adjustment

(a) Remove the shield case cover from the MEP-339. Change jumper connection for J556 to (2)-(3), and adjust R292 until the voltage across TP1 and TP2 is 0.00 V ±0.03 mV.

(b) Change the jumper connection for J556 to (1)-(2), and adjust R295 until the voltage across TP1 and TP2 is 10.000 V ±3 mV.

(c) Adjust R301 until the voltage across TP1 and TP4 is -3.30 V.

(d) Press [PHASE] [MHz dB sec] (PHASE OFFSET), and use the DATA knob to set phase offset to 2000. Press [kHz +dBm msec], then use the DATA knob again to set G.D. offset to 0. Press [kHz +dBm msec] again, and use the DATA knob to set G.D. offset fine to 0. Adjust R297 until the voltage across TP1 and TP6 is 3.000 V ±5 mV.

(e) Change the jumper connection for J555 into (2)-(3), then adjust R307 until the voltage across TP1 and TP5 is 0.00 ±0.03 mV.

(f) Return the jumper connection for J555 to (1)-(2).

(2) 3.33 MHz, 33.3 MHz, and 30 MHz filters adjustment

(a) Set the POWER switch to STANDBY. Disconnect C418 and TP7 on the board (by removing the appropriate side of the C418 lead).

(b) Connect the output of the tracking generator (of the second spectrum analyzer) to the lead of C418 just removed. The ground connection for the tracking generator output should be located as near to C418 as possible. Set the tracking generator output level to around -30 dBm.

(c) Set the POWER switch to ON. Observe the signal response at the emitter of Q56 with the high-impedance probe attached to the input of the spectrum analyzer. Adjust C422 until the filter response is symmetrical at 3.333 MHz.

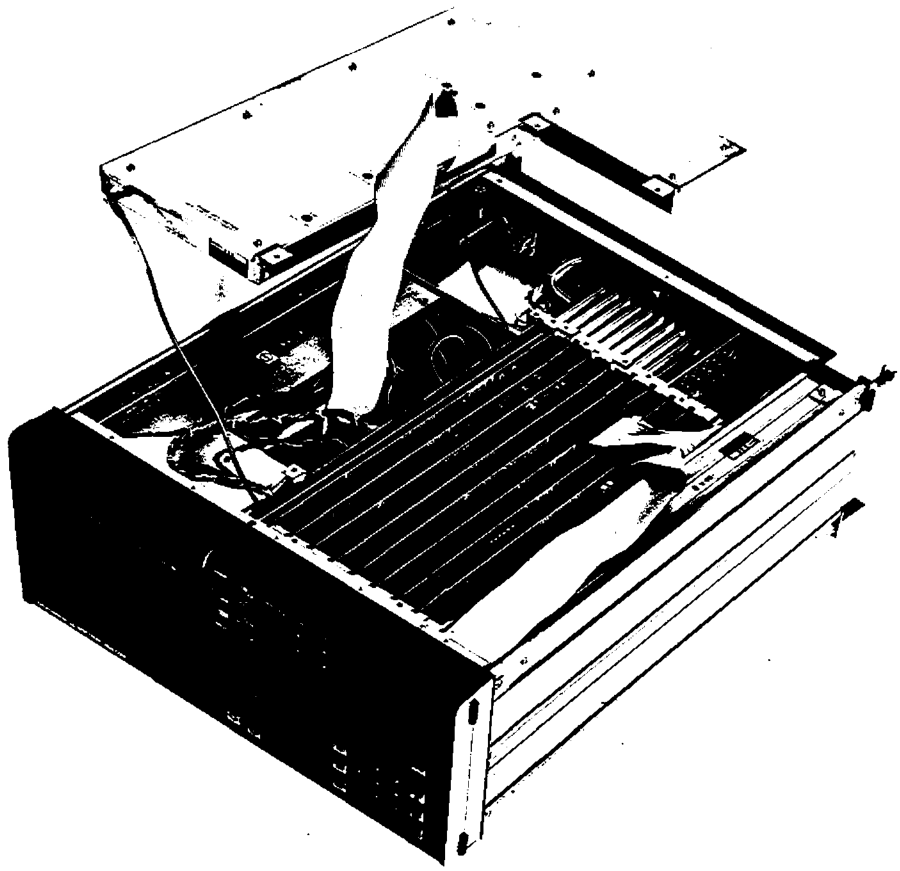


Fig. 11-30 Phase and group delay adjustment (BLP-010205, MEP-339)

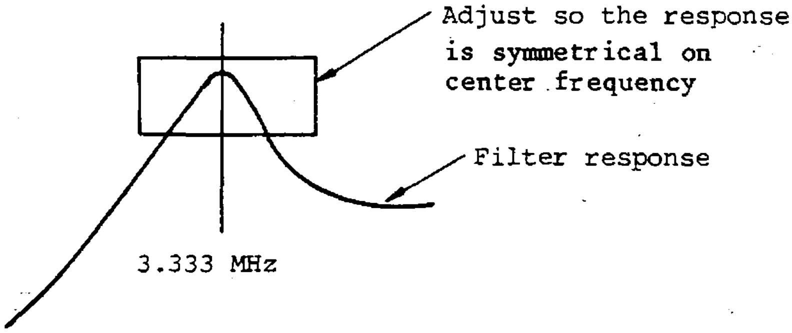


Fig. 11-31 Filter adjustment - 1

(d) Observe the signal at the Q57 collector. Adjust C425 until the filter response is symmetrical at 3.333 MHz.

(e) Set POWER switch to STANDBY. Reconnect the lead of C418 to its original pattern location. Reset the POWER switch to ON.

(f) Apply the output of the tracking generator (contained in the second spectrum analyzer) to J553 (PHASE INPUT). Set the tracking generator output to about 0 dBm. Press PHASE then use the DATA knob to set the phase scale to 40°/div.

(g) Observe the signal waveform at the Q47 emitter. Adjust C386 until the filter response is symmetrical at 3.333 MHz.

(h) Observe the signal waveform at the Q48 collector. Adjust C391 until the filter response is symmetrical.

(i) Reduce the tracking generator output from 0 to -30 dBm. Observed the signal waveform at the Q42 collector. The center frequency for observation is 33.33 MHz.

(j) Adjust C351 until the signal response is symmetrical at 33.33 MHz. Adjust C505 so the level of the signal resolution is reduced with its bandwidth broadened.

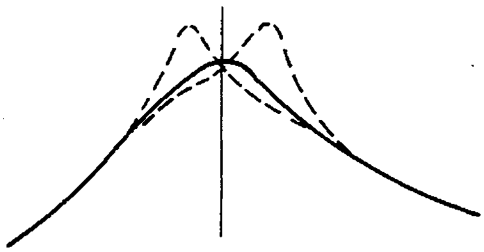


Fig. 11-32 Filter adjustment - 2

(k) Set the POWER switch to STANDBY, and disconnect C369 and C433 on the board (by removing the appropriate side of the C369 lead).

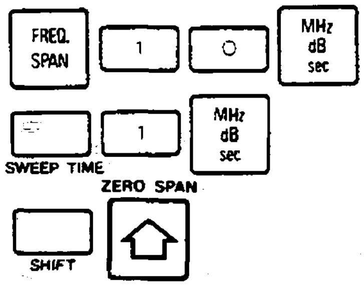
(l) Connect the output of the tracking generator (contained in the second spectrum analyzer) to the lead of C369 just removed. The ground connection for the tracking generator output should be taken as near to C369 as possible. Set the tracking generator output to about -30 dBm.

(m) Set the POWER switch to ON. Connect the spectrum analyzer high impedance probe to the Q44 collector. Adjust C371 until the signal response observed is symmetrical at 30.0 MHz. Adjust C506 so the level of the signal response is reduced, and its bandwidth broadened.

(n) Set the POWER switch to STANDBY, and reconnect the lead of C369 to its original pattern location. Set the POWER switch to ON again.

(3) Output gain and offset adjustment

(a) Connect the TR4172 tracking generator output to its RF input. Press PHASE then use the DATA knob to set the phase scale to 40°/div. Set up the TR4172 panel as follows:



(b) Press PEAK SEARCH, then adjust R273 until the marker readout is within +180 $\pm 0.4^{\circ}$. Press PEAK SEARCH again to confirm the readout.

(c) Press [ ] [ ] (SHIFT, NEG. PEAK S.), then adjust R265 until the marker readout is within -180 $\pm 0.4^{\circ}$. Press [ ] [ ] (SHIFT, NEG. PEAK S.) again to confirm the readout.

(d) Press [PHASE] [kHz +dBm msec] (G. D. OFFSET), then use the DATA knob to set G.D. offset to 2000. Press [kHz +dBm msec] (G. D. OFFSET) again, then set G.D. offset fine to 0 with the DATA knob.

(e) Adjust R281 so there are 7.5 sawtooth wave forms (2700°) within the horizontal scale span on the TR4172. To shift the signal trace in the horizontal direction, press [MHz dB sec] (PHASE OFFSET), then use the DATA knob.

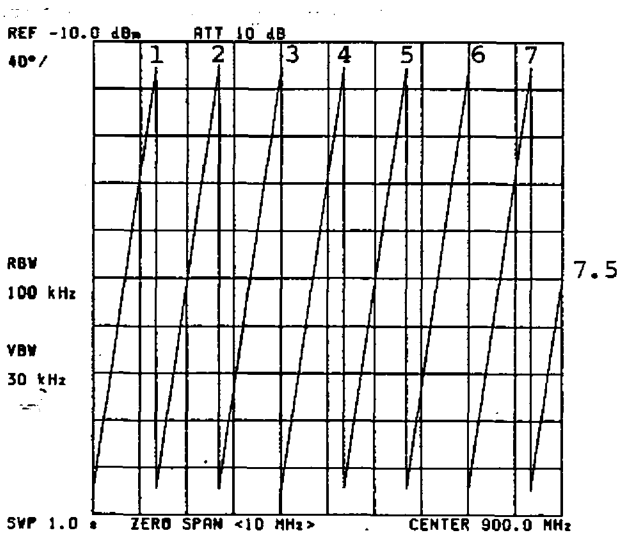


Fig. 11-33 G.D. offset adjustment

(f) Press PHASE, then set the phase scale to 8°/div. with the DATA knob. Press kHz (G.D. Offset), then set G.D. offset to 0 with the DATA knob. Press kHz (G.D. Offset) again, then set G.D. offset fine to 250 with the DATA knob.

(g) Press MHz (Phase Offset), and adjust phase offset with the DATA knob until the signal response trace is centered on the display screen.

(h) Press PEAK SEARCH, Δ, SHIFT NEG. PEAK S., and read the phase value with the delta marker. Adjust R285 until the phase readout is 50.8 ±0.5°.

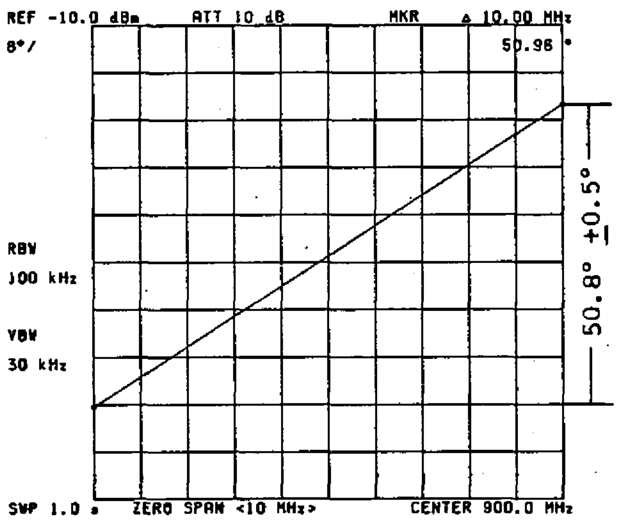


Fig. 11-34 G.D. offset fine adjustment

(i) Proceed with phase offset adjustment. Set up the TR4172 as follows:

PHASE	40°/div. (with the DATA knob)
kHz +dBm msec (G. D. OFFSET)	G.D. offset to 0 (with the DATA khob)
kHz +dBm msec (G. D. OFFSET)	G.D. offset fine to 0 (with the DATA knob)
MHz dB sec (PHASE OFFSET)	Phase offset to 0 (with the DATA knob)
MARKER	

(j) While increasing phase offset from 0 to 4000° with the DATA knob, adjust R283 so the marker readout increases from 0 to 500° as shown below:

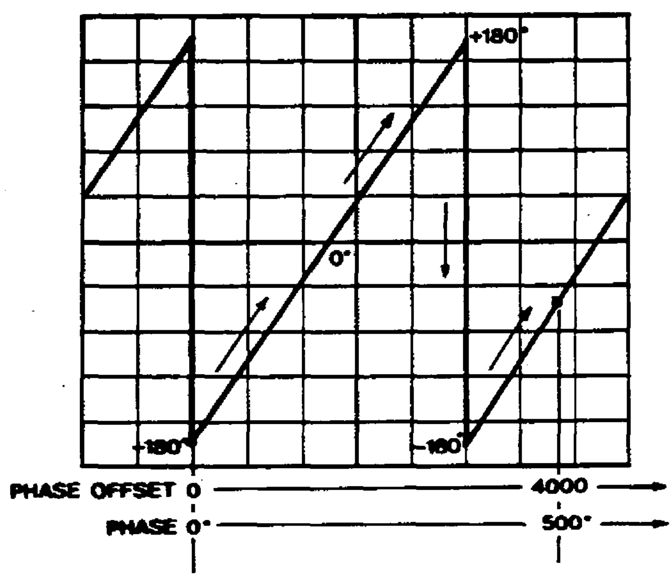


Fig. 11-35 Phase offset adjustment

(k) Remount the shield case cover on the phase board (MEP-339).

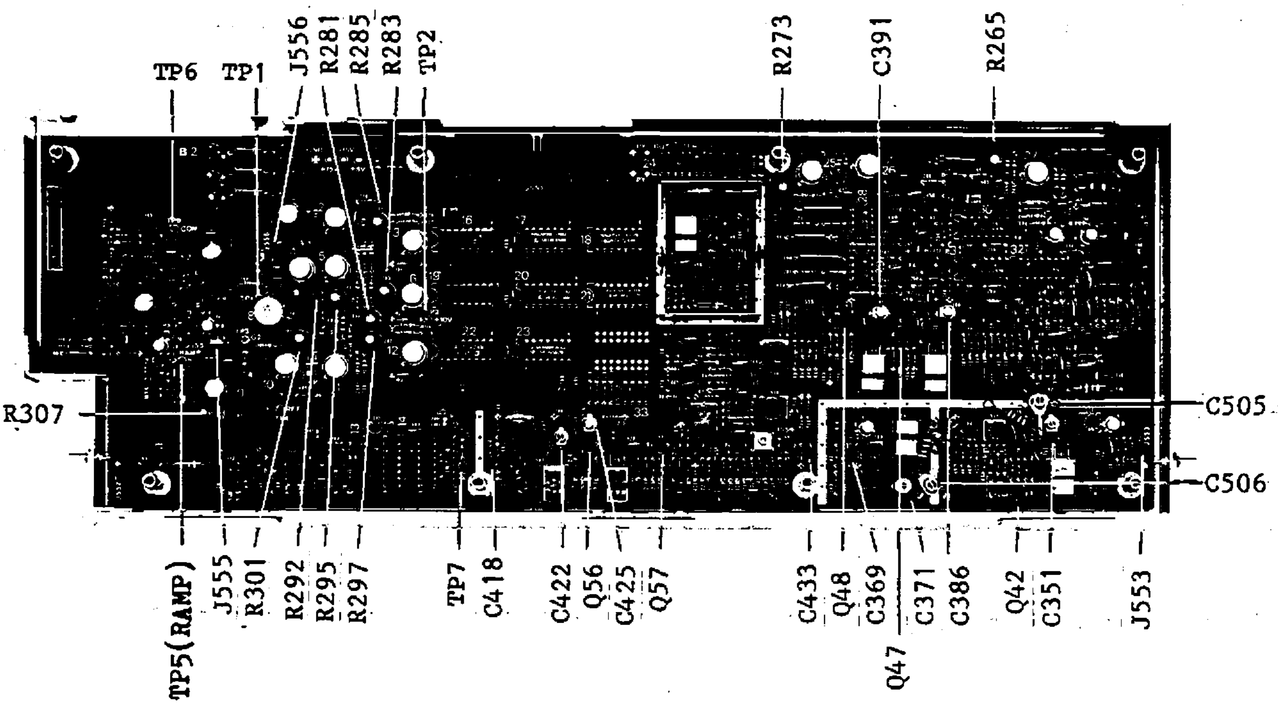


Fig. 11-36 Location of adjustments of PHASE BLOCK (BLP-010205)

11-6. RF SECTION ADJUSTMENT

This paragraph describes TR4172 RF section adjustment.

11-6-1. RF Power Supply Adjustment (Board No. BLF-010370)

(Circuit diagram No. 36)

Instrument required: Digital voltmeter

(1) Set the POWER switch to ON, and check the supply voltage at each test point. Figure 11-37 shows the location of the test points and adjustments.

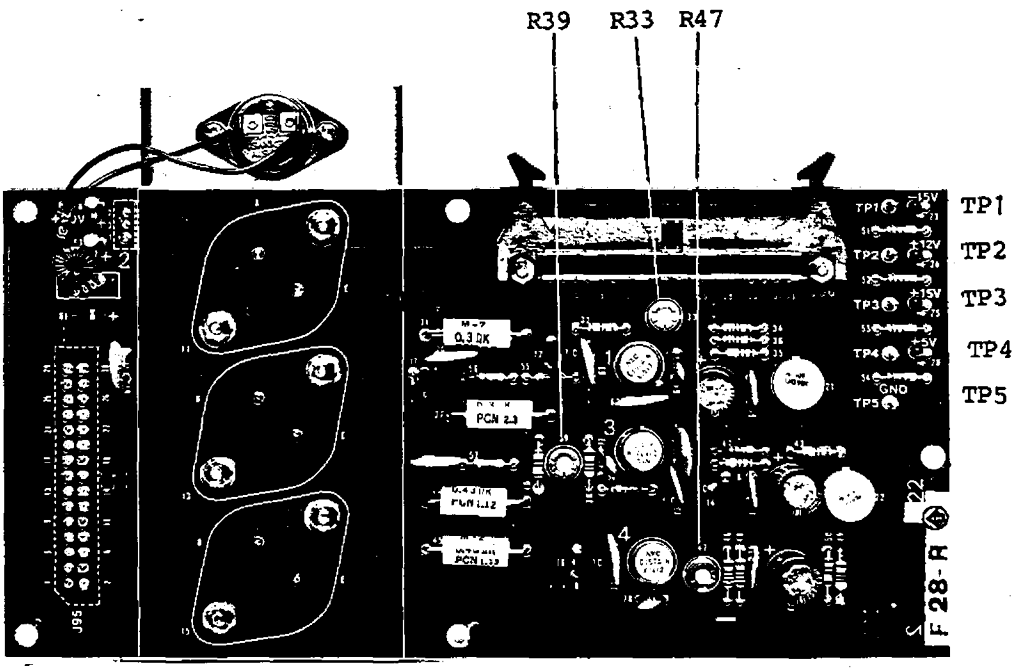


Fig. 11-37 RF Power (BLF-010370) Adjustment

(2) Adjust controls corresponding to each test point in the following order so that the voltages are within the specifications shown in Table 11-7. Always adjust the +15 V at TP-3 first.

Table 11-7 Test points and adjustment

Order	Test point	Voltage	Adjustment
1	TP-3	+15 V ±0.01 V	R39
2	TP-1	-15 V ±0.01 V	R33
	TP-2	+12 V	
3	TP-4	+5 V ±0.01 V	R47
	TP-5	GND	

11-6-2. Tuning and Level Adjustment for 50 MHz standard (CAL) Signal (Board: BLB-010135) MEP-342 (Circuit diagram No. 48)

Instruments required: * Spectrum analyzer
* Power meter

(1) Remove retention screws for the standard block (MEP-342) and arrange it so the block is easily accessible.
Remove the shield case cover from the block.

(2) Change the jumper connection for J141 to (2)-(3). Connect the 50 MHz STD. OUT (J55) to the input to the external spectrum analyzer.

(3) While observing the 50 MHz STD. OUT signal with the external analyzer, adjust L121 through L126 until the maximum peak response is attained.

(4) Change the jumper connection for J141 to (1)-(2), then connect the power meter to the 50 MHz STD OUT. (J55). Adjust R61 until the power meter reading is -20.00 dB ±0.3 dB.

(5) Reinstall the shield case cover on the block, and secure the block (MEP-342) in its original position on the chassis.

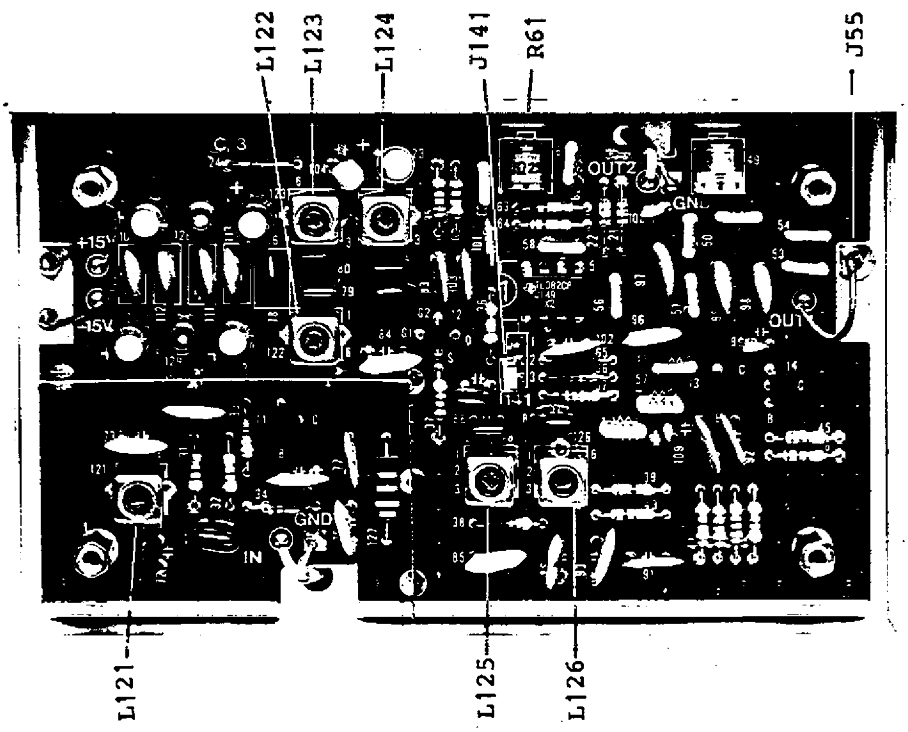


Fig. 11-38 50 MHz STD OUT. adjustment

11-6-3. Offset and Gain Adjustment for ATT. I/O and Level Cal
(Board. No. BGN-010220) (Circuit diagram No. 38)

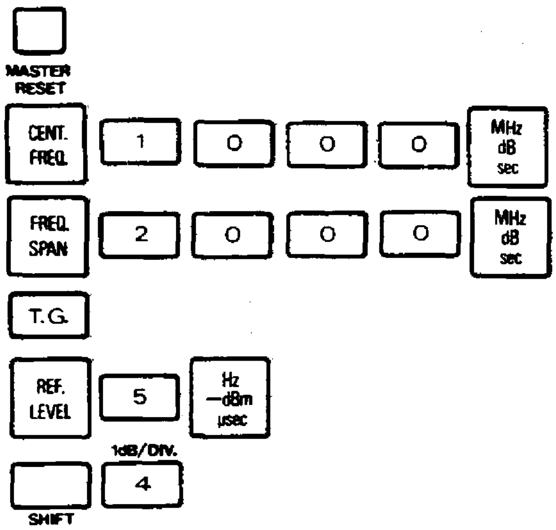
Instrument required: Digital voltmeter

(1) Connect the digital voltmeter across the test point TP RF CAL on the ATT I/O board and the chassis ground.

(2) Turn the CAL. control on the front of the TR4172 completely counterclockwise. Turn R96 on the board completely counterclockwise to minimize the gain. Press [SHIFT] [ZERO SPAN ⇧] to select zero frequency span.

(3) Adjust R167 until the voltmeter reading is 2.0 V $\pm$0.1 V.

(4) Connect the TR4172 tracking generator output to its RF input using a cable having a flat frequency response. Set up the TR4172 as follows:



(5) Adjust R96 so the flat portion of the signal response trace is as horizontal as possible.

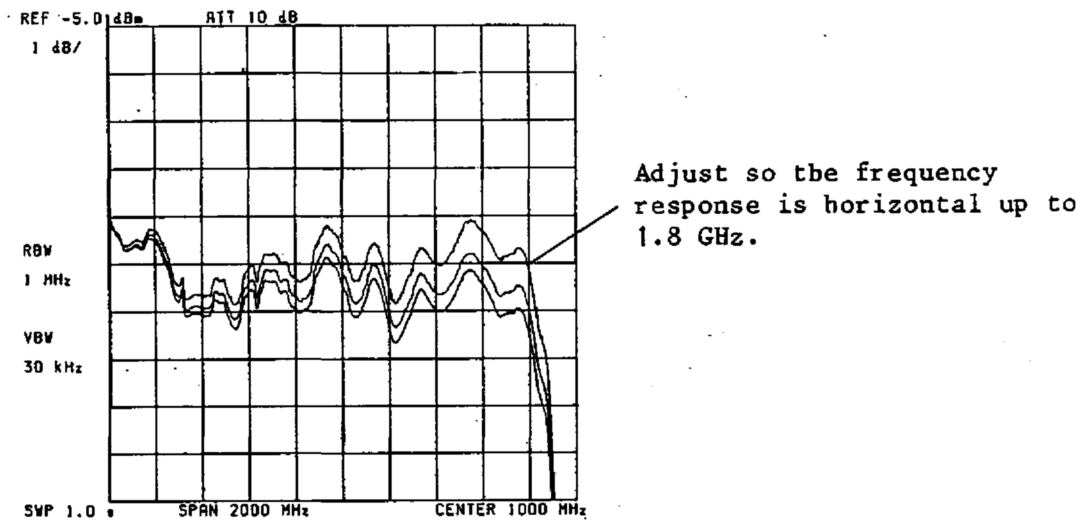


Fig. 11-39 Frequency response correction

11-6-4. YTO Main and FM Tune Adjustment (Board Nos. YIG I/O: BGN-010219, YIG Driver: BLC-010224) (Circuit diagrams Nos. 37, 45)

Instruments required: * Digital voltmeter
* Frequency counter
* Synthesized signal generator
* Marker generator

(1) Reference voltage adjustment for YIG I/O board

(a) Set the POWER switch to STANDBY, and remount the YIG Oscillator I/O board (BGN-010219) in its slot via a 22 pin. extension card. The cables connected to the board connectors should be as they were during adjustment. Set the POWER switch to ON again.

Note: Before changing connections of jumpers, set the POWER swtich to STANDBY.

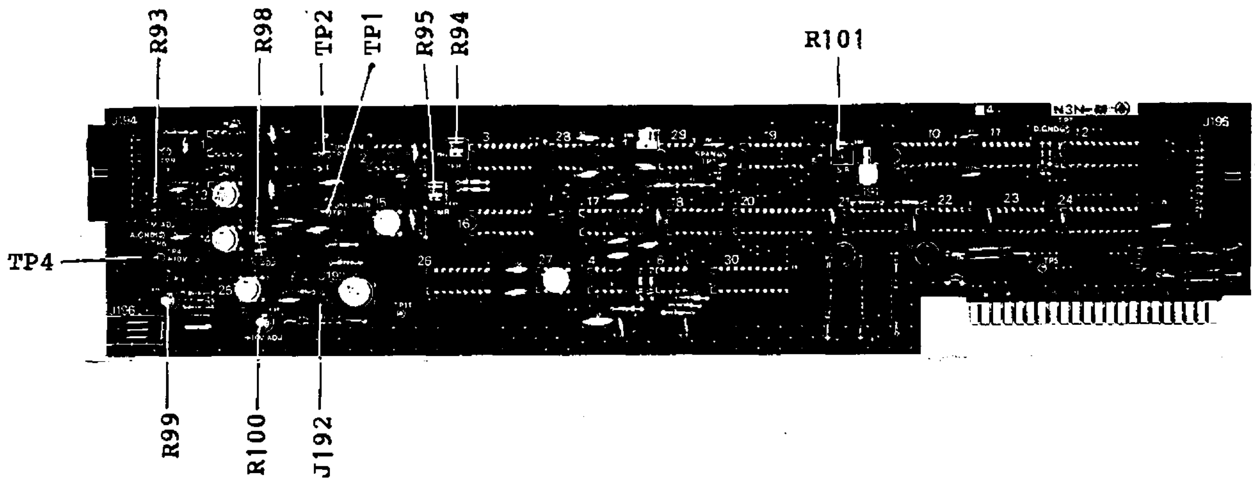


Fig. 11-40 Locations of adjustments on the YIG Oscillator I/O board (BGN-010219)

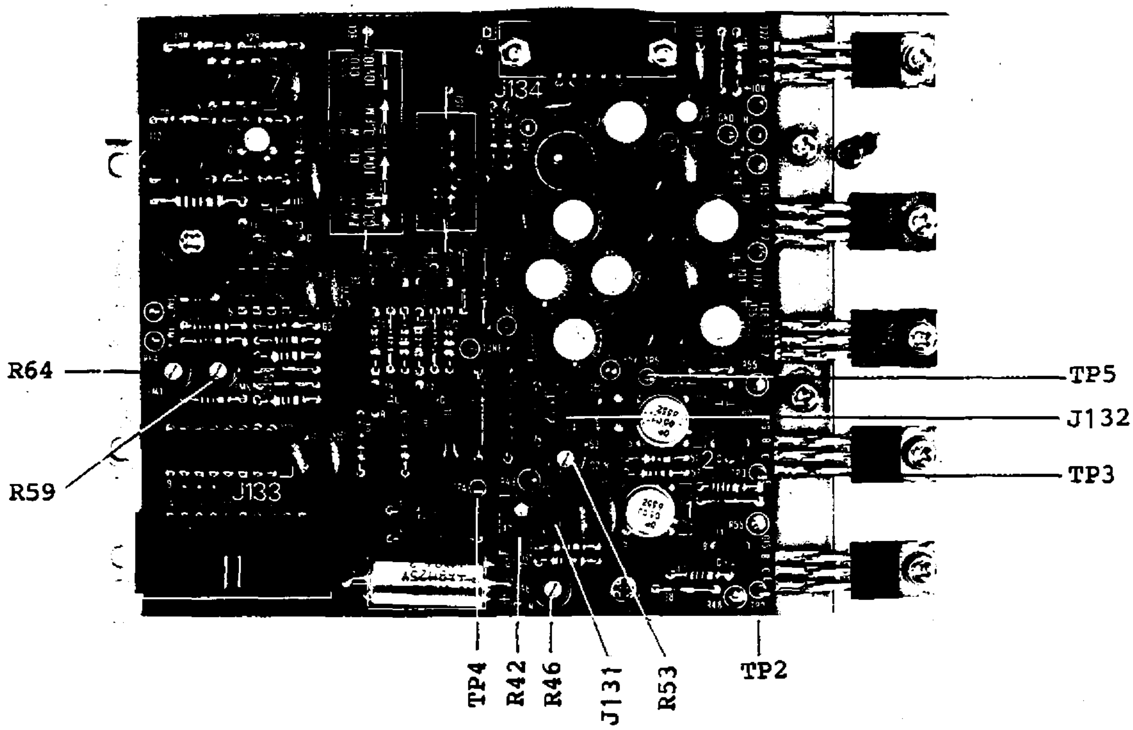


Fig. 11-41 Locations of adjustments on the YIG Oscillator Driver board (BLC-010224)

(b) Change the jumper connection for J192 (on the YIG Oscillator I/O board) to (2)-(3). Adjust R99 on the same board until the voltage across TP-6 (GND) and TP-4 is 0.00 V ±0.03 mV.

(c) Change the jumper connection for J192 into (1)-(2). Adjust R100 until the voltage across TP-6 (GND) and TP-4 is 10.000 V ±3 mV.

(2) Offset null adjustment for YIG Driver board

(a) Change the jumper connection for J131 (on the YIG Oscillator Driver board) into (2)-(3). Adjust R46 on the same board until the voltage across TP-4 (GND) and TP-2 is 0.00 V ±0.03 mV.

(b) Change the jumper connection for J132 (on the YIG Oscillator Driver board) to (2)-(3). Adjust R53 on the same board until the voltage across TP-5 (GND) and TP-3 is 0.00 V ±0.03 mV.

(c) Return the jumper connections for J131 and J132 to (1)-(2).

(3) YTO Main Tune adjustment

(a) Prepare TR4172 as follows:

[MASTER RESET]

[SHIFT] [ZERO SPAN ⇧]

[SHIFT] [LABEL] [Hz −dBm μsec] [INT.] A [1] [0] [0] [0] [Hz −dBm μsec]

The step Main is set to 1000.

(b) Adjust R95 on the YIG Oscillator I/O board until the voltage across TP-1 and TP-6 (GND) on the same board is -5.000 V ±3 mV.

(c) Check the YTO frequency with a frequency counter. Disconnect cable from the output of the 3.9 GHz LPF and connect the frequency counter to the output of the 3.9 GHz LPF section (MEP-351).

(d) Press [SHIFT] [LABEL] [Hz −dBm μsec] [LINE] B [2] [0] [0] [0] [Hz −dBm μsec] to set the step FM to 2000. Press [SHIFT] [LABEL] [Hz −dBm μsec] [INT.] A [1] [0] [0] [Hz −dBm μsec] to set Step Main to 100.

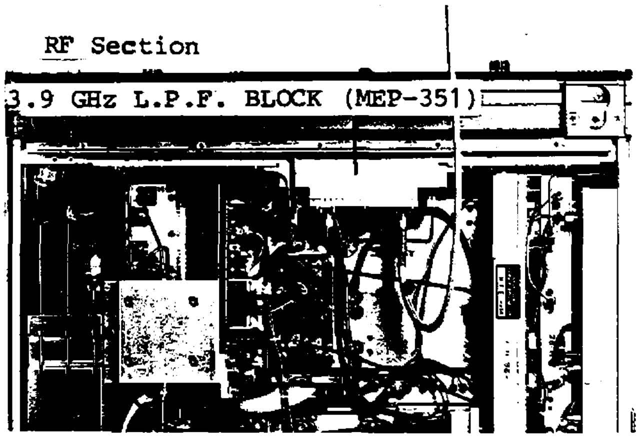


Fig. 11-42 YTO frequency measurement

(e) Adjust R42 on the YIG Oscillator Driver board until the counter reading is 2046 MHz ±300 kHz.

(f) Press [1] [9] [0] [0] [Hz -dBm μsec] to set Step Main to 1900. Adjust R93 on the YIG Oscillator I/O board until the counter reading is 3846 MHz ±300 kHz.

(g) Repeat above steps several times as R42 (on the driver board) and R93 (on the I/O board) affect each other.

(h) When completing the YTO Main Tune adjustment, disconnect the frequency counter from the output of the 3.9 GHz LPF section (MEP-351) and connect the output to the original cable.

(4) YTO Main Span accuracy adjustment

(a) Set up the TR4172 as follows:

[ ] MASTER RESET

[CENT. FREQ.] [5] [0] [0] [MHz dB sec]

[FREQ. SPAN] [1] [0] [0] [0] [MHz dB sec]

(b) Set up the synthesized signal generator output for 500 MHz and a level of -10 dB, and couple it to the input of the TR4172.

(c) Center R98 on the YIG Oscillator I/O board.

(d) Adjust R101 on the YIG Oscillator I/O board so the signal responses are positioned to the leftmost, center, and rightmost graticules on the screen as shown in the following figure.
When R101 is adjusted, however, R86 and R92 on the 3rd Local I/O board also require adjustment. (See page 11-58)

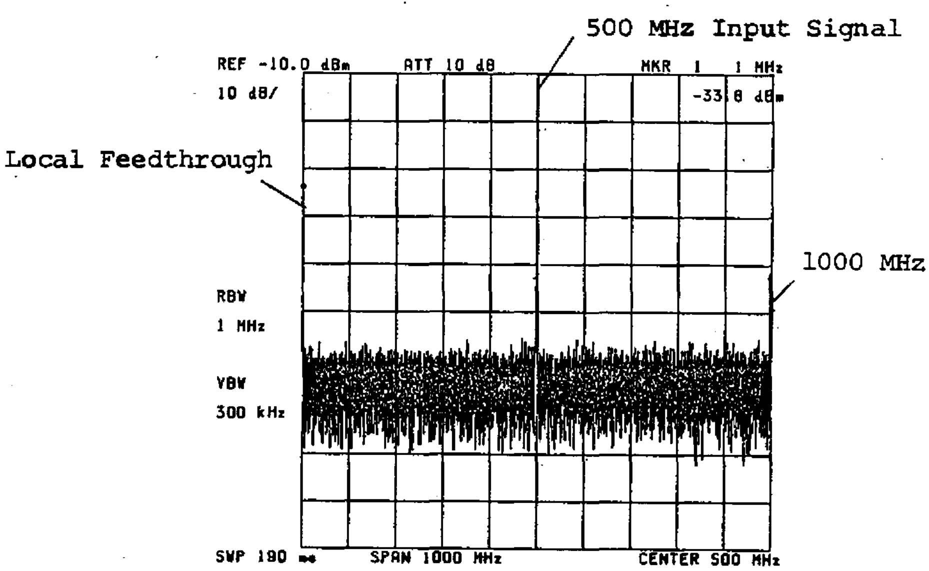
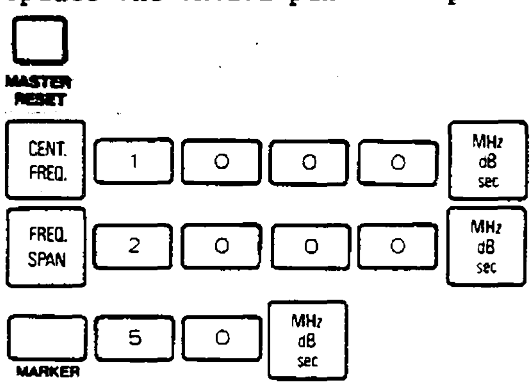


Fig. 11-43 YTO main span adjustment (1)

(e) Apply the 50 MHz STD. (CAL.) signal to the TR4172 input.
Update the TR4172 panel setup as follows:



(f) Adjust R98 on the YIG Oscillator I/O board until the marker is positioned at the peak of the 50 MHz CAL. signal response.

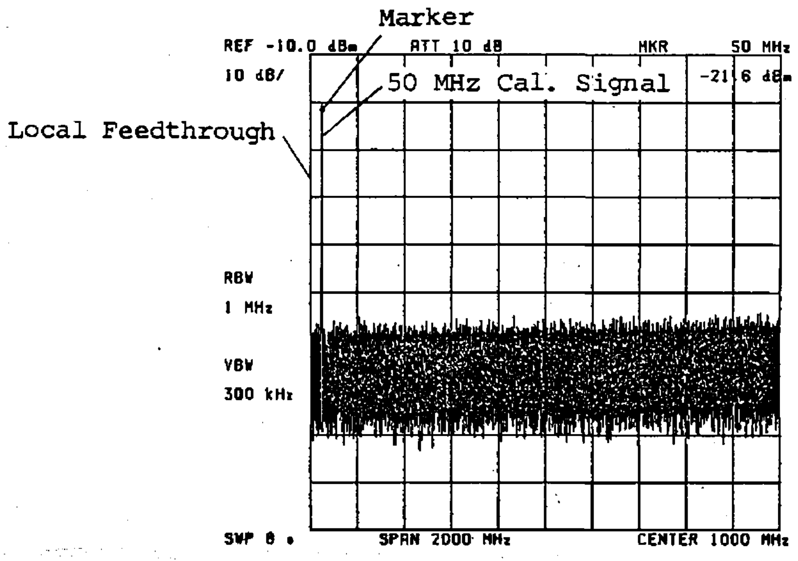
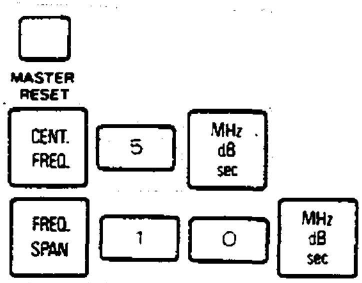


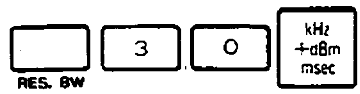
Fig. 11-44 YTO main span adjustment (2)

(5) YTO FM tune and span accuracy adjustment

(a) Connect the output of a marker generator to the TR4172 input. Setup the marker generator output for a 1 MHz comb signal with fullpower around 0 dBm. Update the TR4172 panel setup as follows:



(Cent. Freq. Repositioning Cancel)



(b) Adjust R59 on the YIG Oscillator Driver board until each response of the 1 MHz comb signal is positioned at each vertical graticule on the screen. (See Figure 11-44.) The signal response on the screen can be shifted horizontally by pressing CENT. FREQ. key and then using the DATA knob.

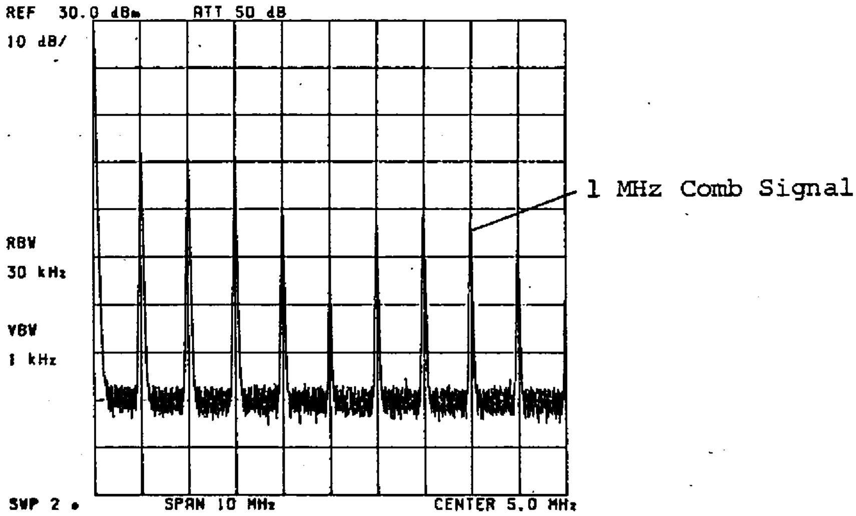


Fig. 11-45 YTO FM tune adjustment (1)

(c) Disconnect the TR4172 marker generator, then set center frequency to 0 MHz. Press [SHIFT] [LABEL] [Hz/-dBm/μsec] [LINE]B [2] [0] [0] [0] [Hz/-dBm/μsec] to set Step FM to 2000.

(d) Adjust R94 on the YIG I/O board until the voltage across TP-2 and TP-6 (GND) on the same board is -5.000 V ±3 mV.

(e) Adjust Step 3RDA (by pressing [SHIFT] [LABEL] [Hz/-dBm/μsec] [EXT.]C and using the DATA knob) or Step Main (by pressing [SHIFT] [LABEL] [Hz/-dBm/μsec] [INT.]A and using the DATA knob) to center the local feedthrough.

(f) Press [SHIFT] [LABEL] [Hz/-dBm/μsec] [LINE]B [0] [Hz/-dBm/μsec], and while changing the Step FM setting to 0, 2000, and 4000 by operating [0] [Hz/-dBm/μsec], [2] [0] [0] [0] [Hz/-dBm/μsec] then [4] [0] [0] [0] [Hz/-dBm/μsec], adjust R64 on the YIG Oscillator Driver board so the local feedthrough is positioned to the rightmost, center, and leftmost graticule on the screen, respectively.

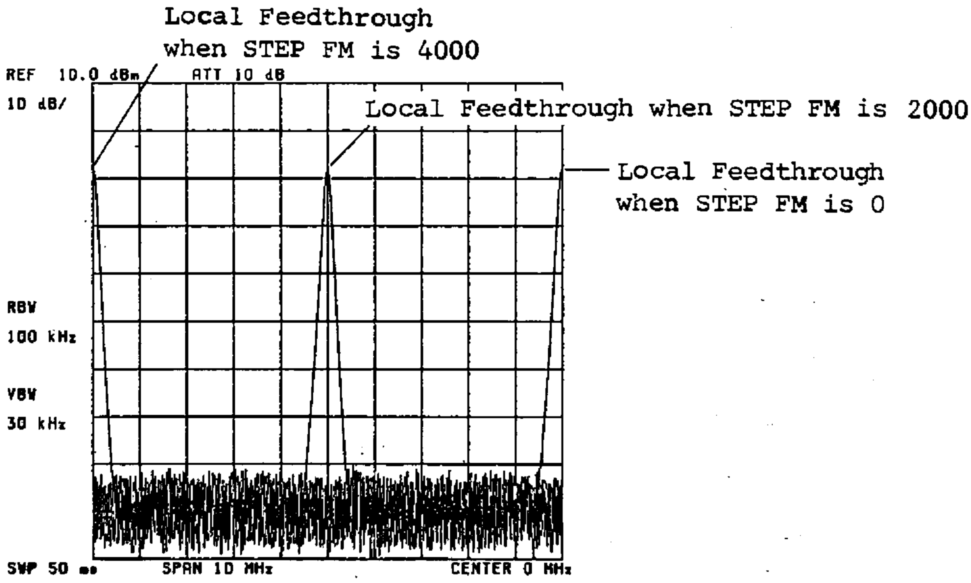


Fig. 11-46 YTO FM tune adjustment (2)

(g) Set the POWER switch to STANDBY. Remount the YIG Oscillator I/O board in its original slot (without the extender board). Set the POWER switch to ON again.

11-6-5. 3rd Local I/O Adjustment (Board No. BGN-010221)

(Circuit diagram No. 39)

Instruments required: * Digital voltmeter

* Marker generator

(1) Reference voltage adjustment and adjustment of Tune D-A, B, C

(a) Set the POWER switch to STANDBY, then remount the 3rd Local I/O board (BGN-010221) in its slot via an extension card (22 pins). The cables connected to the on-board connectors should be left as they are. Set the POWER switch to ON again.

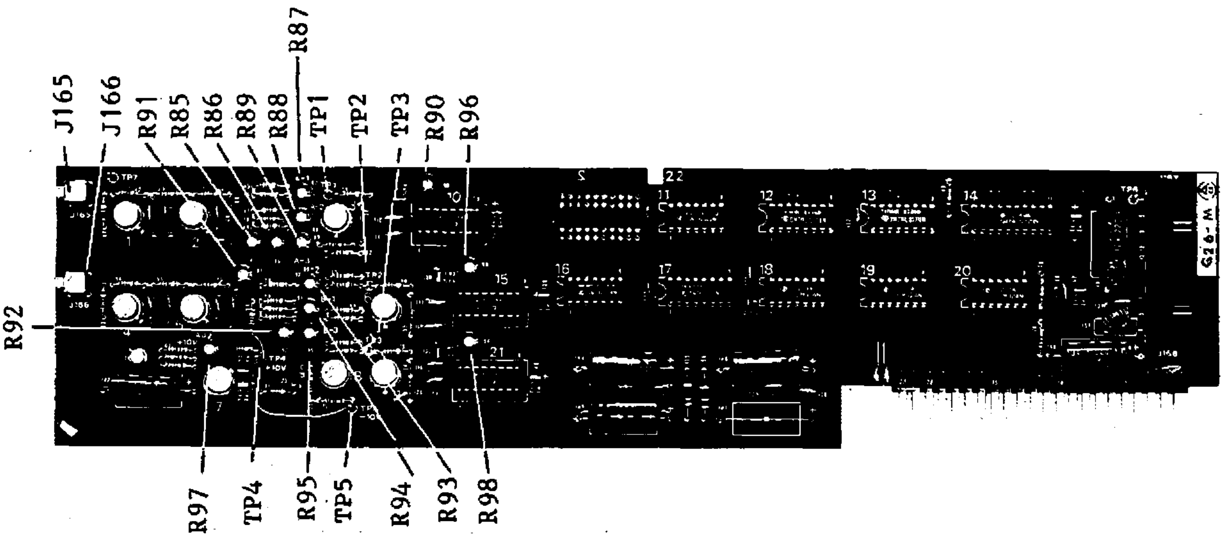


Fig. 11-47 3rd local I/O adjustment (BGN-010221)

(b) Connect the digital voltmeter across Tp-4 and TP-7 (GND). Adjust R97 until tbe voltmeter reads 10.000 V ±3 mV.

(c) Set up the TR4172 as follows:

[MASTER RESET]

[FREQ. SPAN] [5] [0] [0] [kHz +dBm msec]
ZERO SPAN

[SHIFT] [⇧]

[SHIFT] [LABEL] [Hz −dBm μsec] [EXT.] C [1] [0] [0] [0] [Hz −dBm μsec]

[SHIFT] [LABEL] [Hz −dBm μsec] [VIDEO] D [5] [0] [Hz −dBm μsec]

[SHIFT] [LABEL] [Hz −dBm μsec] [SINGLE] E [5] [0] [Hz −dBm μsec]

(d) Check the voltage across TP-7 (GND) and TP-1, TP-2, and TP-3. Adjust R90, R96, and R98 until the voltage at each test point is 5.000 V ±3 mV.

(2) Gain and offset adjustment for Sweep A (20 MHz VCO) Tune

(a) While the TR4172 is set up as shown in paragraph (1)-(c), change Step 3RDA to 0, then 2000 (by operating [SHIFT] [LABEL] [Hz −dBm μsec] [EXT.] C , then using the DATA knob). Adjust R87 so the output voltage change at J165 is within ±4.000 V when Step 3RDA is changed from 0 to 2000.

(b) Set Step 3RDA to 1000 (by pressing [SHIFT] [LABEL] [Hz/−dBm/µsec] [EXT.] C, then using the DATA knob). Change Step 3RDB into 0, then 100 (by pressing [SHIFT] [LABEL] [Hz/−dBm/µsec] [VIDEO] D, then using the DATA knob). Adjust R88 so the output voltage change at J165 is within ±20 mV when Step 3RDB is changed from 0 to 100.

(c) Set Step 3RDB to 50 (by pressing [SHIFT] [LABEL] [Hz/−dBm/µsec] [VIDEO] D, then using the DATA knob). Change Step 3RDC into 0 and 100 (by pressing [SHIFT] [LABEL] [Hz/−dBm/µsec] [SINGLE] E, then using the DATA knob). Adjust R89 so the output voltage change at J165 is within ±2 mV when Step 3RDC is changed from 0 to 100.

(d) Set Step 3RDC to 50 (by pressing [SHIFT] [LABEL] [Hz/−dBm/µsec] [SINGLE] E, then using the DATA knob). At this time, Steps 3RDB and 3RDA are set at 50 and 1000 respectively. Adjust R85 until the output voltage at J165 is 5.000 V ±5 mV.

(3) Gain and offset adjustment for Sweep B (2 MHz VCO) Tune

(a) Set frequency span to 50 kHz.

(b) Set Step 3RDA to 500, then 1500. Adjust R94 so the output voltage change at J166 is within ±4.000 V.

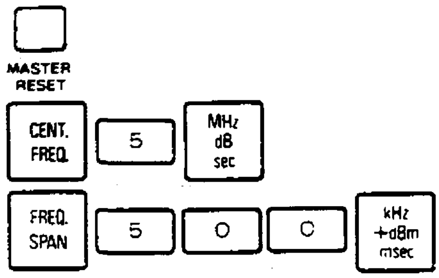
(c) Set Step 3RDA to 1000. Set Step 3RDB to 0 then to 100. Adjust R93 so the output voltage change at J166 is within ±40 mV when Step 3RDB is changed from 0 to 100.

(d) Set Step 3RDB to 50. Set Step 3RDC to 0, then to 100. Adjust R95 so the output voltage change at J166 is within ±4 mV.

(e) Set Step 3RDC to 50. Step 3RDB and 3RDA are set at 50 and 1000 respectively. Adjust R91 until the output voltage at J166 is 5.000 V ±5 mV.

(4) Sweep A and B span accuracy adjustment

(a) Set up the TR4172 as follows:



(b) Connect marker generator output to the TR4172 input. Set the marker generator output to 50 kHz comb signal of full power about 0 dBm.

(c) Adjust R86 so the 50 kHz comb signal responses are aligned to each vertical graticule on the screen as shown below.

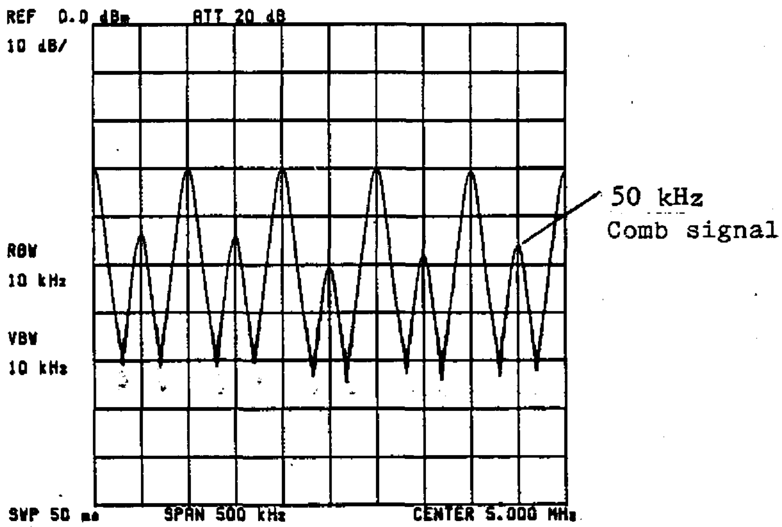


Fig. 11-48 Span accuracy adjustment

(d) Set frequency span to 50 kHz. Set the marker generator output to 5 kHz comb signal.

(e) Adjust R92 so the 5 kHz comb signal responses are aligned to each vertical graticule on the screen.

(f) Set the POWER switch to STANDBY. Return the third Local I/O board into its original slot, then reset the POWER switch to ON.

11-6-6. Counter Adjustment (Board No. BLJ-010131) MEP-349

(Circuit diagram No. 74)

Instruments required: * Digital voltmeter

* Function generator

(1) -1.8 V power supply adjustment

(a) Set the POWER switch to STANDBY, and remove the counter section (MEP-349) from the chassis. Use extension cables to establish the original electrical connections between the counter section and the analyzer mainframe (see Figure 11-49).

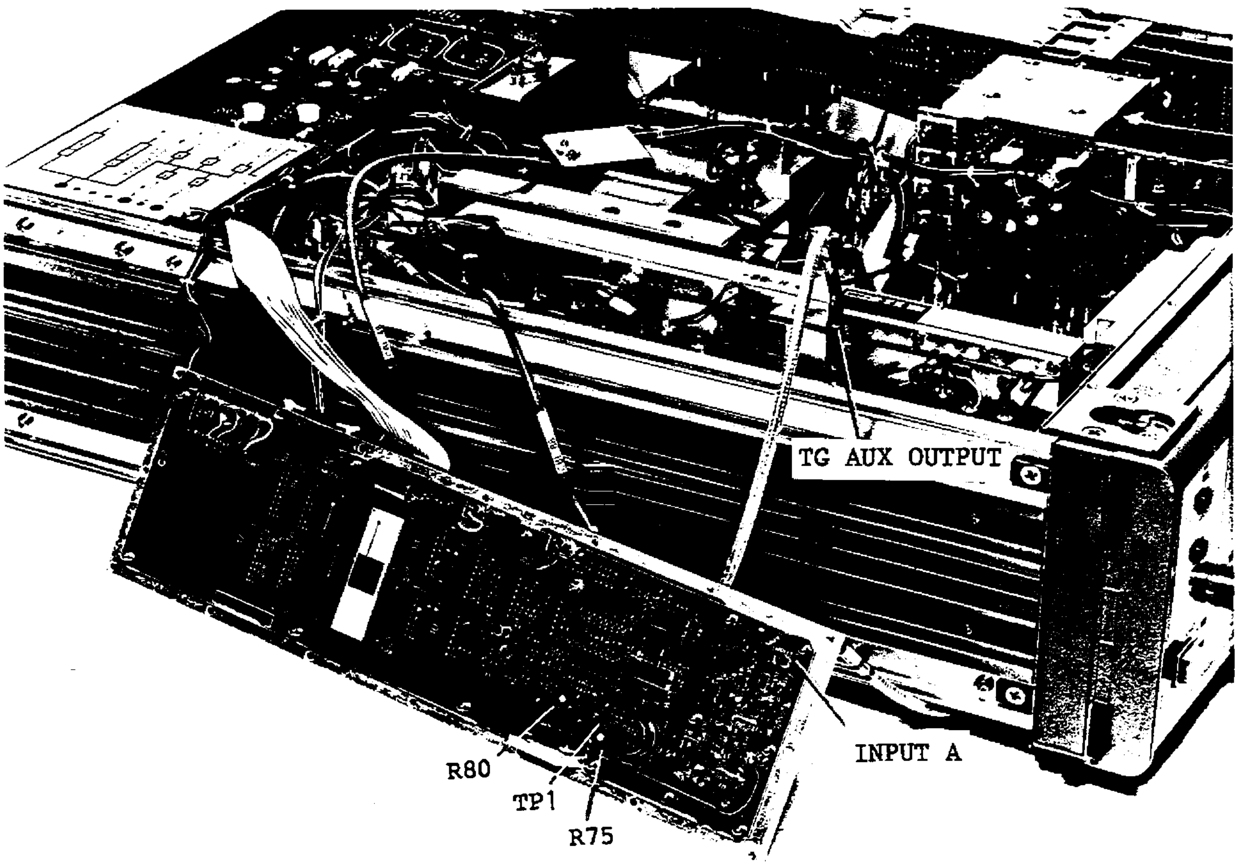
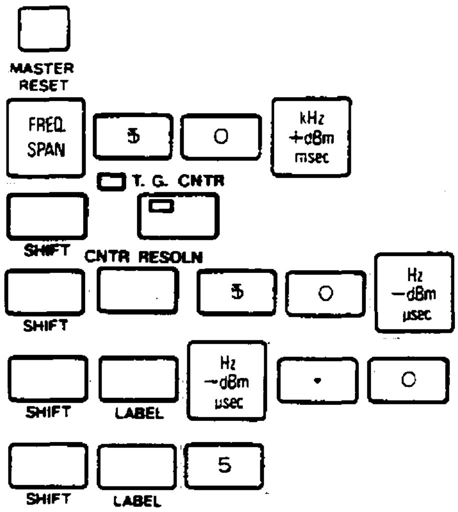


Fig. 11-49 Counter adjustment (MEP-349)

(b) Set the POWER switch to ON. Connect the digital voltmeter to TP-1 on the board, and adjust R80 until the voltage at TP-1 is -1.8 ±0.01 V.

(2) Schmitt trigger sensitivity adjustment

(a) Set up the TR4172 as follows:



(b) Disconnect the cable between the counter input A and TG AUX, then apply the function generator output to the counter input A. Set up the function generator output for a 100 kHz sine wave and -20 dBm output level.

(c) Press MARKER to count the input signal frequency to the counter. While gradually reducing the function generator output level adjust R75 until the maximum counter sensitivity (at which the counter readout does not flicker) is obtained.

(e) Set the POWER switch to STANDBY. Return the Counter section into its original position in the chassis, then reset the POWER switch to ON.

11-6-7. RF Section Adjustment (Board No. BLP-010133) MEP-345 (Circuit diagram No. 53)

Instruments required: * External spectrum analyzer
* High impedance probe

(1) Second local OSC (1840 MHz) adjustment

(a) Using the external spectrum analyzer, observe the signal response at J20 (second local output of 1840 MHz for TG). Turning C237 will change the oscillation frequency and peak level of the second local OSC output as shown below. Set C237 to the point where the oscillator output level is 1 dB below its peak.

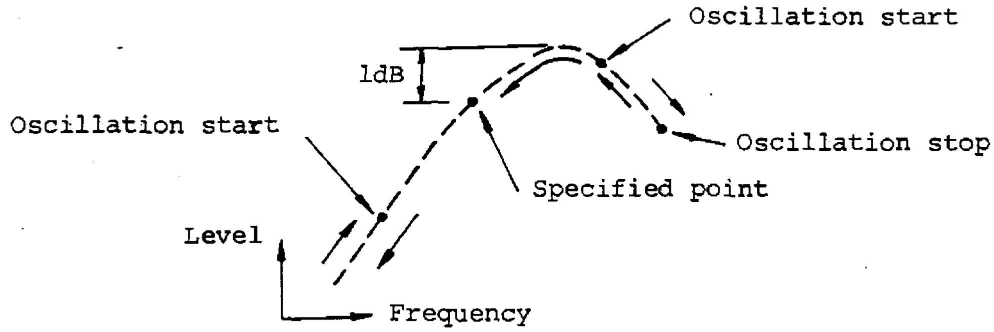


Fig. 11-50 Second local OSC adjustment

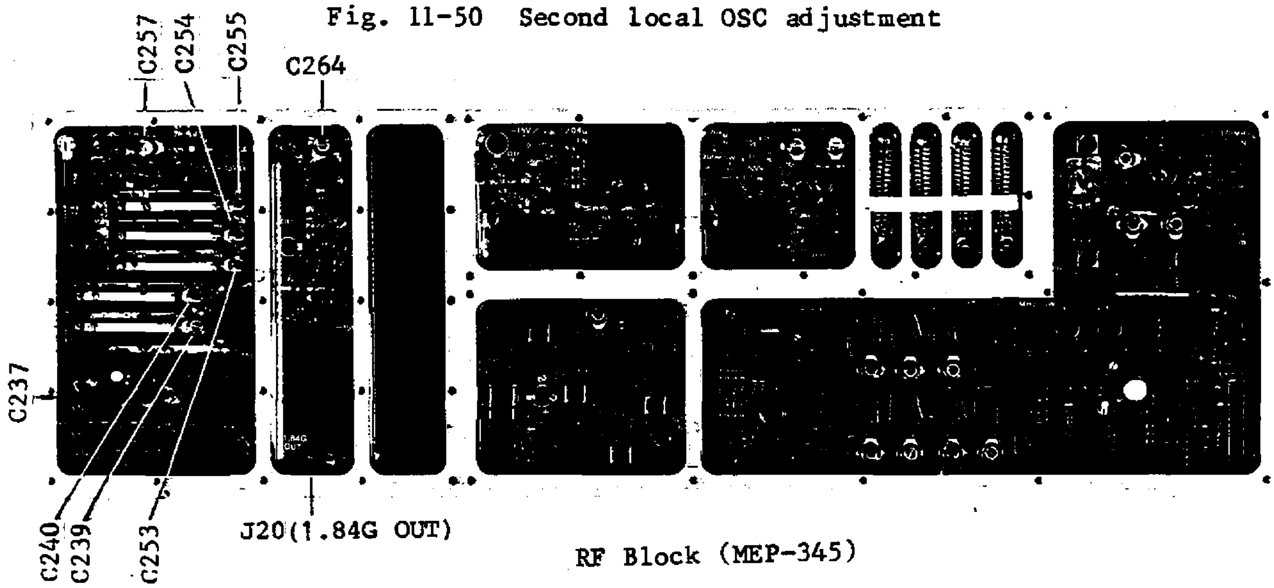


Fig. 11-51 Location of adjustment and connectors on RF block (MEP-345) -1

(b) Adjust C239, C240, C253, C254, C255, C257, and C264 several times until the maximum output level at 1840 MHz is attained.

(c) Adjustment of step (b) will slightly affect the adjustment of step (a). Adjust C239 again so the oscillation level is positioned to 1 dB below the peak oscillation level.

(d) Restore the original connection to J20.

(2) Fourth local OSC (33.33 MHz) adjustment

(a) Using the external spectrum analyzer, observe the signal response at J23 (fourth local OSC output of 33.33 MHz, approximately 0 dBm for TG). Adjusting L430 will change the oscillation frequency and peak level. Set L430 to the point where the oscillation level is 0.5 dB below the peak level.

(b) Adjust L432 until the maximum output level is attained.

(c) Using the external spectrum analyzer, observe the signal response at J24 (fourth local OSC output of 33.33 MHz, approximately -10 dBm for counter). Adjust L433 until the maximum output level is attained.

(d) Remove the shield case cover from the fourth local block in the RF Section (MEP-345). Using the external spectrum analyzer with a high impedance prove attached, observe the signal response at the Q25 collector. Adjust C375 until the maximum observed signal level is attached.

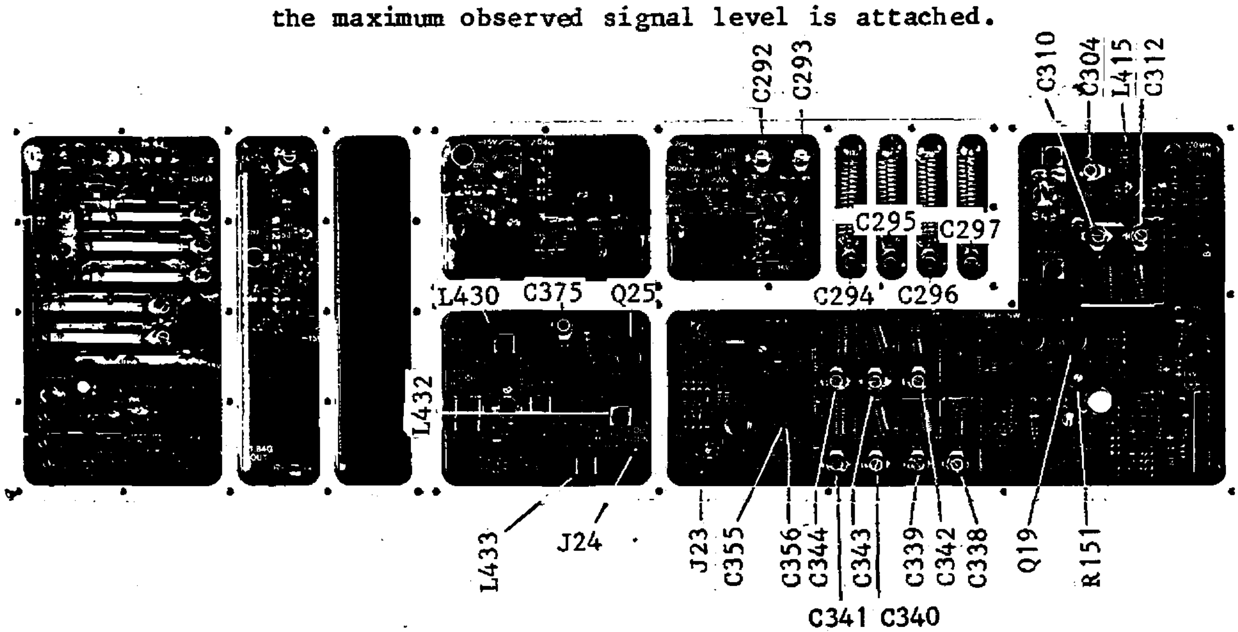


Fig. 11-52 Location of adjustment and connectors on RF block (MEP-345) -2

(e) Restore the original connections for J23 and J24.

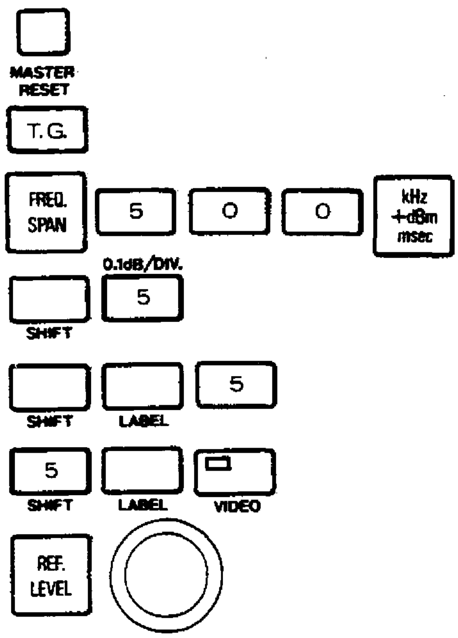
(3) Third local amplifier (176.3 MHz) adjustment

Using the external spectrum analyzer with the high impedance probe, observe the signal response at the L415 center tap. Adjust C304 until the maximum observed signal level (at approximately 176 MHz) is attained.

(4) Second IF B.P.F. (206 MHz) adjustment

(a) Fine tune level deviation is adjusted by adjusting this filter. Set up the TR4172 as follows:

Connect the TRACKING GENERATOR OUTPUT to INPUT-1, then press as follows:



(b) Adjust C292, C293, C294, C295, C296, and C297 so the ripple is less than 0.3 dBp-p, being careful to keep the symmetry of the signal response and its level as high as possible (see the following figure).

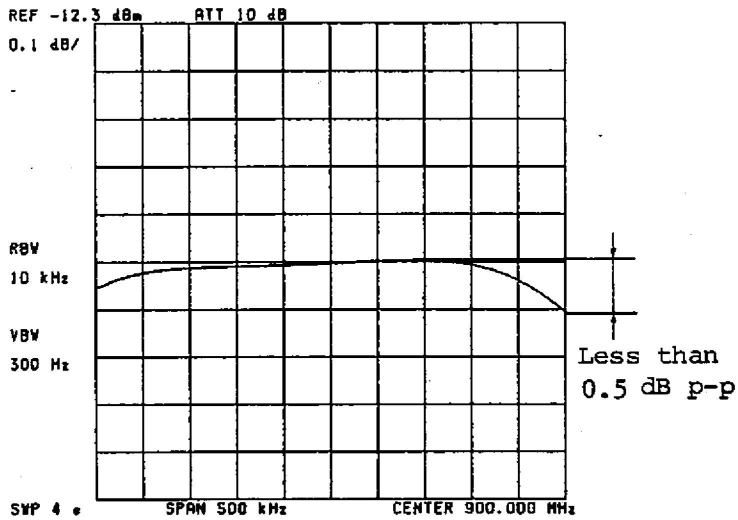
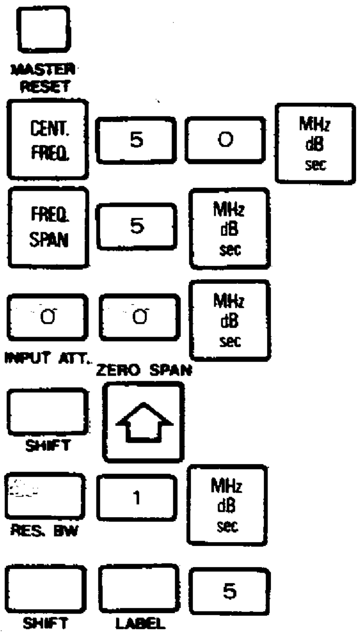


Fig. 11-53 2nd IF BPF adjustment

(5) Third IF B.P.F. (30.0 MHz) adjustment

(a) Set up the TR4172 as follows:

Connect the CAL OUT to INPUT-1.



(b) Using the external spectrum analyzer with the high impedance probe, observe the signal response at the Q19 collector on the board. Set the center frequency of the external spectrum analyzer to 30.00 MHz.

(c) Press [SHIFT] [LABEL] [Hz −dBm µsec] [LINE] B, then change the Step FM setting with the DATA knob. Adjust C310 and C312 so the observed 30 MHz B.P.F. response (two stages) is centered around 30.00 MHz and its maximum level is attained. (See Figure 11-54.) A slight ripple within the pass bandwidth may be ignored.

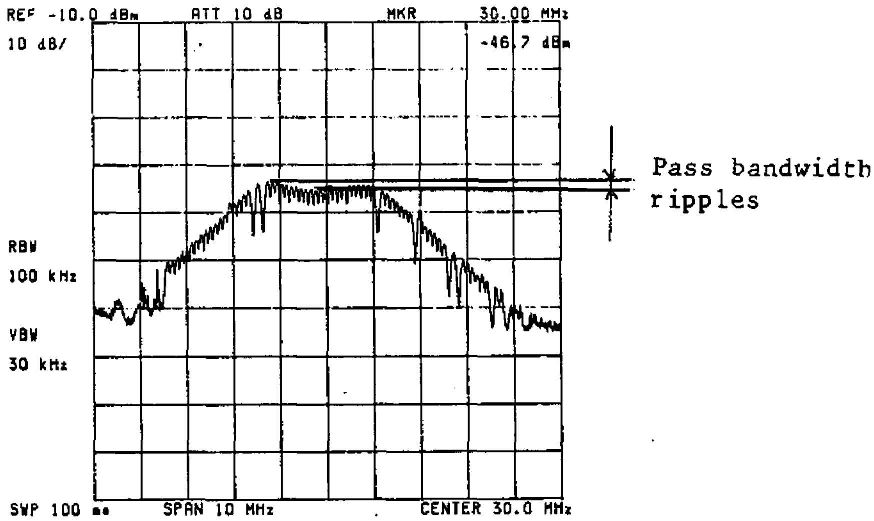


Fig. 11-54 30 MHz B.P.F. (two stages) adjustment

(d) Using the external spectrum analyzer with the high impedance probe, observe the signal response at the connection between C355 and C356. Press [SHIFT] [LABEL] [Hz −dBm µsec] [LINE] B, then use the DATA knob to change the Step FM setting. Adjust C342, C343, and C344 so the observed 30 MHz (three stage) B.P.F. response has a 1 MHz 0.5 dB bandwidth and a maximum level of about 30.00 MHz is attained. (See Figure 11-55.) Step FM will change in 2 kHz steps. If a smaller frequency stepping is desired, press [SHIFT] [LABEL] [Hz −dBm µsec] [EXT.] C.

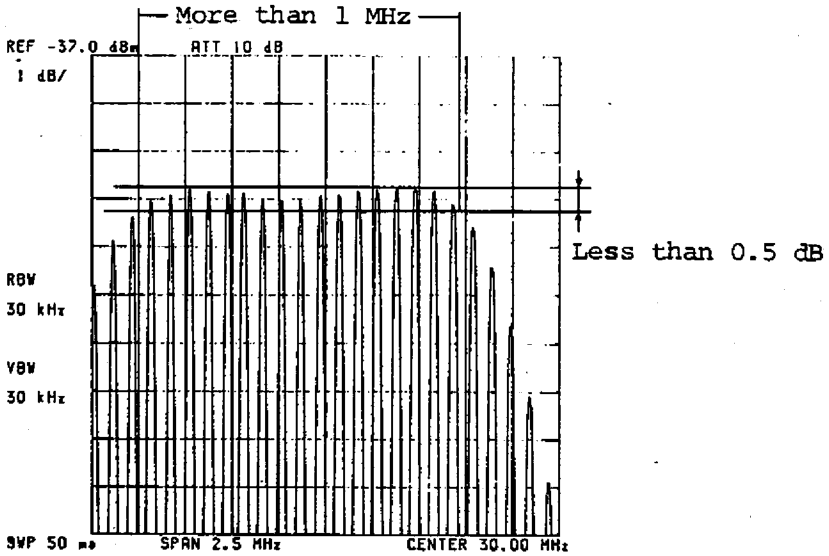


Fig. 11-55 30 MHz (three stage) B.P.F. adjustment

(e) Press [RES. BW] [3] [0] [0] [kHz/+dBm/msec] to change resolution bandwidth to 300 kHz. As in step (4), adjust C338, C339, C340, and C341 so the filter response has a 0.5 dB bandwidth greater than 300 kHz and its maximum level is about 30.00 MHz.

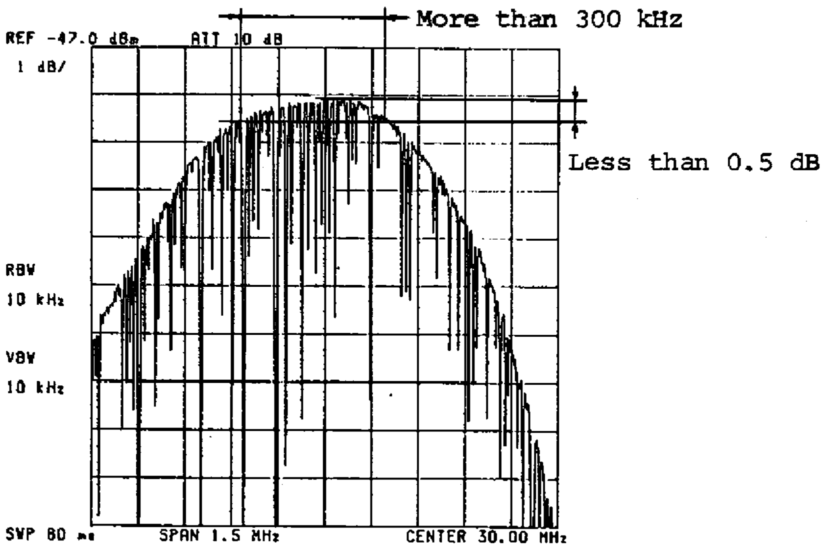
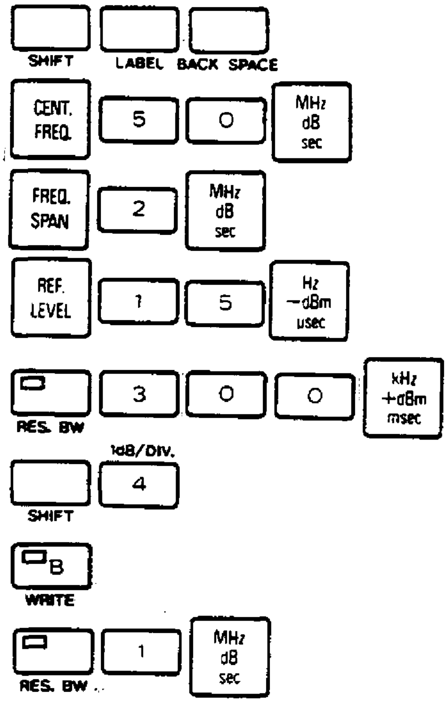


Fig. 11-56 30 MHz B.P.F. adjustment (four stages)

(f) Remount the shield case cover removed in paragraph 2.

(6) Resolution bandwidth 1 MHz, and 300 kHz level deviation adjustment

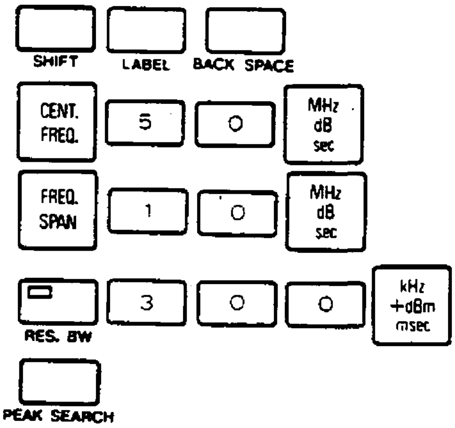
(a) Connect the CAL OUT connector on the TR4172 to its INPUT-1 connector, then set up the instrument as follows:



(b) Through the above setup, the signal response at a 300 kHz resolution bandwidth is viewed on TRACE A, while that at a 1 MHz resolution bandwidth is viewed on TRACE B. Adjust R221 until the signal level at 1 MHz resolution bandwidth is identical to that at 300 kHz resolution bandwidth.

(7) Total gain adjustment

(a) Connect the CAL OUT. to INPUT-1, then set up the TR4172 as follows:



(b) Adjust R151 until the marker level readout is -20.0 dBm ±0.1 dB.

11-6-8. Tracking Generator Block Adjustment (MEP-346 circuit diagram No. 54)

(Board and circuit Nos.
Tracking Generator-1 BLJ-010128 No. 55
Tracking Generator-2 BLJ-010129 No. 56
Tracking Generator-3 BLJ-010130 No. 57)

Instruments required: * Spectrum analyzer
* Signal generator
* High impedance probe

(1) 3.33 MHz local OSC adjustment

(a) Set the POWER switch to STANDBY, and remove the TG block (MEP-346) from the chassis. For quick removal, temporarily remove the standard block (MEP-342) and counter switch (MEP-349) before removing the TG block. Use extension cables to establish the original electrical connections between the TG block and the analyzer mainframe. (See Figure 11-57.)

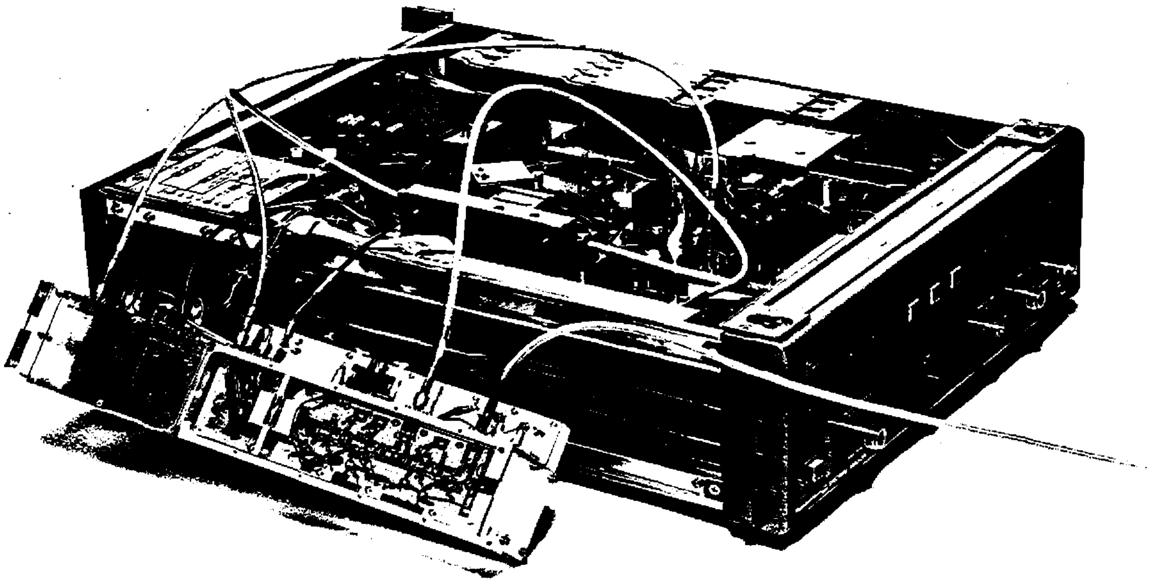


Fig. 11-57 MEP-346 removal

(b) Set the POWER switch to ON. Set the T.G. FREQ. ADJ control on the front panel to the center position. Then press PHASE to select the phase measurement mode.

(c) Connect J40 (3.33 MHz local output for phase) on the Tracking Generator block to the counter to count its output frequency. Adjust C122 on Tracking Generator-2 (BLJ-010129) until the counter readout is 3.333333 MHz ±5 Hz.

(2) 30 MHz B.P.F. adjustment

(a) Press MASTER RESET to initialize the TR4172, then press T.G. to activate the TRACKING GENERATOR OUTPUT.

(b) Connect the external spectrum analyzer to J35 (206 MHz IF output) on the Tracking Generator block (MEP-346) to observe its signal response. At this time, set up the external analyzer for a 206.33 MHz center frequency.

(c) Connect the output of a signal generator to J38 (33.3 MHz local input) on the Tracking Generator block (MEP-346). Set the signal generator output at 33.33 MHz ±5 MHz, approximately −5 dBm.

(d) The 30 MHz B.P.F. response can be observed at the J35 (206.33 MHz) IF output by changing the output frequency of the signal generator. Adjust C156, C159, and C162 until the filter response is symmetrical around 206.33 MHz and its maximum level is attained. A slight ripple within the pass bandwidth may be ignored.

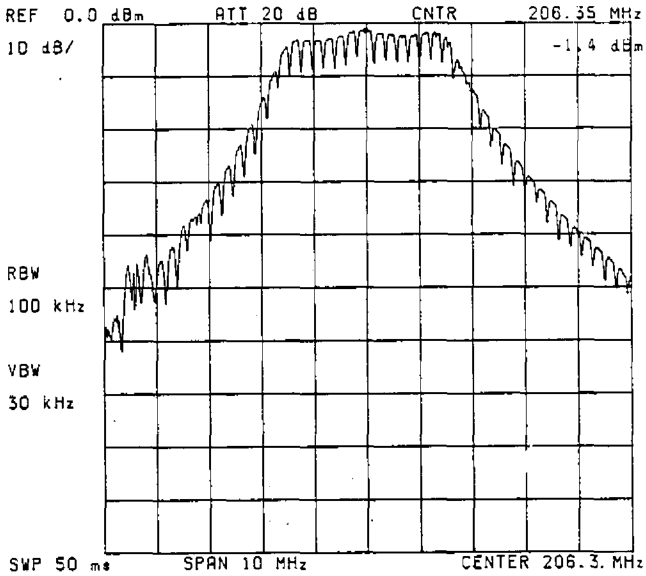


Fig. 11-58 TG 30 MHz B.P.F. adjustment

(e) Disconnect the signal generator from J38 on the Tracking Generator block (MEP346), and restore the original connection.

(3) 206 MHz B.P.F. adjustment

(a) This adjustment should be made directly after the 30 MHz B.P.F. adjustment. Connect the output of the signal generator to J36 (176 MHz local input) on the Tracking Generator block (MEP-346). Set the signal generator output to about 176.33 MHz ±10 MHz, +5 dBm.

(b) The 206.33 MHz B.P.F. response can be observed at the J35 (206.33 MHz IF output) by changing the output frequency of the signal generator. Adjust C179, C184, and C185 until the filter response is symmetrical around 206.33 MHz and its maximum level is attained. (See Figure 11-59.)

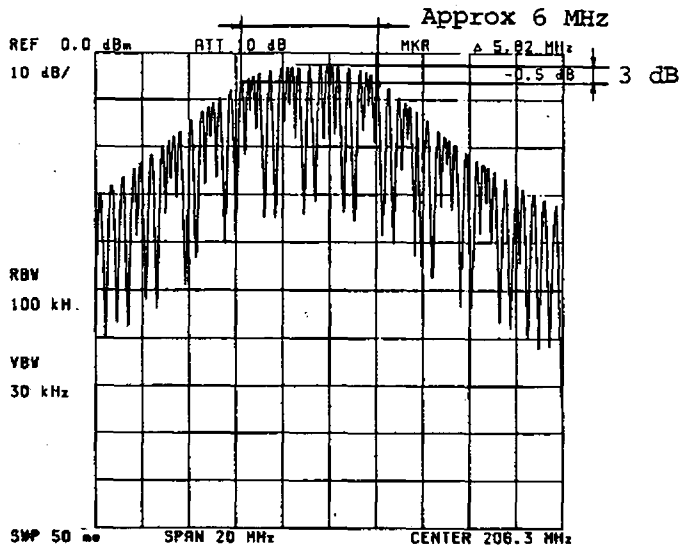


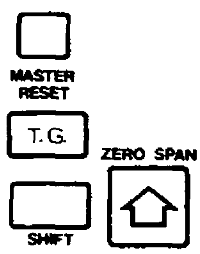
Fig. 11-59 TG 206 MHz B.P.F. adjustment

(c) Disconnect the signal generator from J36 of the Tracking Generator block (MEP346) and restore the original connection. Also disconnect the external spectrum analyzer from J35 and restore the original connection.

(4) TG output 2046 MHz trap adjustment

(a) Remove the shield case cover from the Tracking Generator-1 block (BTF-010128).

(b) Update the TR4172 panel setup as follows:



(c) Connect the external spectrum analyzer to the TRACKING GENERATOR OUTPUT of the TR4172 to observe the T.G. output signal response. Set up the external analyzer for a center frequency of 2046 MHz.

(d) Adjust C120 on the Tracking Generator-1 block until the 2046 MHz signal response level (TG final IF leakage) observed on the external analyzer is minimized.

(e) Remount the shield case cover on the Tracking Generator-1 block.

(5) TG output frequency response compensation

(a) C105 on the Tracking Generator-1 block (BTF-010128) is a TG output frequency response compensating adjustment which is particularly effective for the frequency range above 1000 MHz.

(b) Check the TG output frequency response with a power meter or the external spectrum analyzer, and adjust C104 until the level in the frequency range above 1000 MHz is almost the same as that in the range between 10 and 1000 MHz.

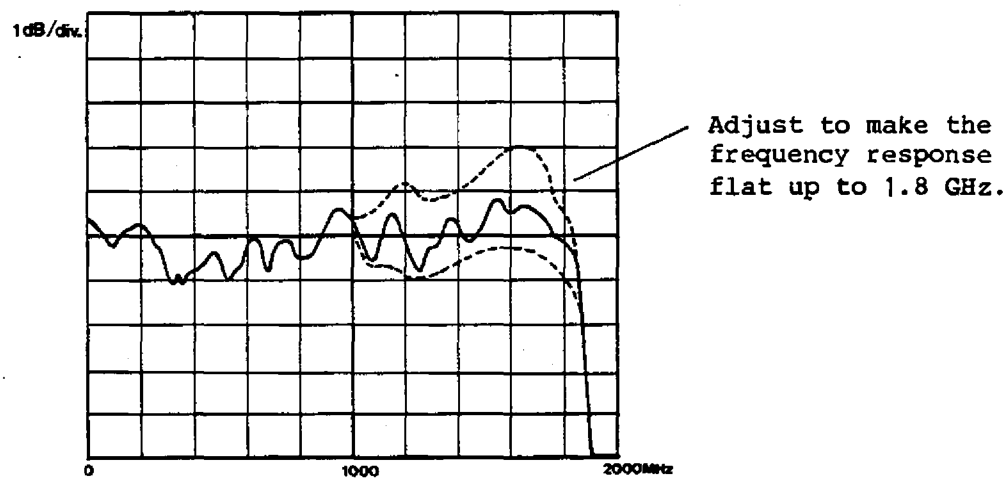


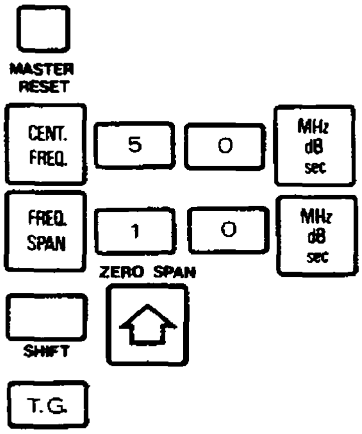
Fig. 11-60 TG output frequency response compensation

(6) TG output level accuracy adjustment

(a) Set the POWER switch to STANDBY. Return the Tracking Generator block (MEP-346) to its original position in the chassis.

(b) Set the POWER switch to ON again, and warm up the instrument for at least 30 minutes.

(c) Set up the TR4172 as follows:



(d) Connect a power meter directly to the TRACKING GENERATOR OUTPUT connector on the TR4172 to check the T.G. output level. Adjust R55 in the Tracking Generator-1 block until the T.G. output level is -10 dBm ±0.1 dB.

11-6-9. 3rd Local Block Adjustment (MEP-347 circuit diagram No. 58)

Board and circuit diagram Nos.
2 MHz VCO BLC-010102 No. 62
39 MHz Mixer BLC-010100 No. 60
3rd local PLL BLC-010103 No. 63
23 MHz VCO BLC-010101 No. 61
176 MHz Mixer BLC-010099 No. 59

Instruments required:
* Signal generator
* Spectrum analyzer
* Standard DC voltage source
* Digital voltmeter
* Frequency counter

(1) 23 MHz VCO voltage-frequency gain adjustment and frequency variation ratio adjustment
This paragraph provides an alignment procedure, when the oscillator FET or varicap for the VCO (230 MHz ±10 MHz) was replaced due to defect.
The voltage-frequency response of the VCO before compensation is shown in the following figure:

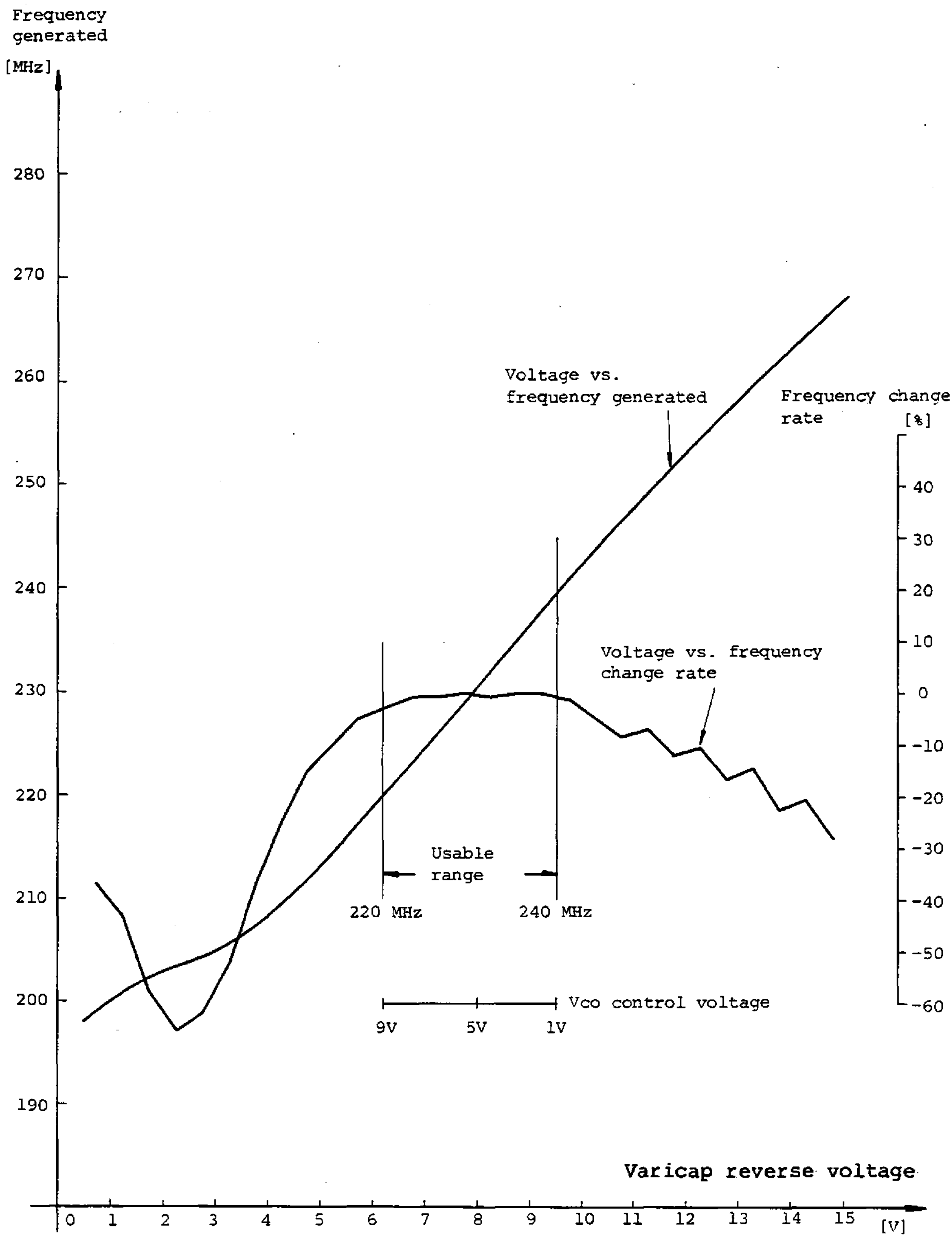


Fig. 11-61 Voltage-frequency response of the VCO

In order to use the constant-variation portion of the response, the reverse voltage applied to the varicap is set at about 8 V. As a result, the frequency variation ratio before compensation is within approximately 5% of the given voltage range.
For adjustment, vary the offset voltage for the varicap to search for the best point of frequency variation ratio before compensation, then fix the offset voltage there. The voltage is normally 8 V ±0.5 V. Adjust the oscillation frequency at that voltage (the center of the variable frequency range). Then adjust the VCO voltage-frequency gain response in the range which will not be subject to compensation. In the range where compensation is required, adjust the voltage at which copensation becomes effective. Some varicap may not require any compensation. Whenever unsoldering is required for a circuit component, be sure to switch off the instrument.

(a) Remove the shield case cover from the 23 MHz VCO. Disconnect the input connection from the 3RDA S. IN, and connect a standard DC output to it. Set the DC output to 5.000 V. Remove the two jumper wires (at D26 and D30) from the board.

(b) Adjust R80 until the voltage at TP-1 is 0.00 V.

(c) Check the voltage across C105 and ground, and adjust R48 until the voltage is -8.0 V.

(d) Set C105 to its center position. Connect the frequency counter to J182 on the board.

(e) Adjust the length of L175 until the counter readout is around 23.00 MHz. Make fine adjustment with C101 until the frequency reading is exactly 23.0000 MHz.

(f) While increasing the output DC from 3 to 7 V in 1 V steps, adjust R88 so the frequency increases at 250 kHz steps.

(g) Increase the DC output from 1 to 9 V in 0.5 V steps (125 kHz steps) to observe the overall frequency veriation ratio. Adjust the varicap offset voltage (-8 ±0.5 V) with R48 so the overall frequency variation ratio is small and the portion requiring no compensation exists in a range from 1 to 5 V or 5 to 9 V. The desirable overall frequency variation ratio is less than 2%.

(h) When compensation is required for the voltage range between 5 and 9 V, install the jumper wire for D30; when that for the voltage range between 1 and 5 V is required, install the jumper wire for D26. It is preferred that compensation be made to only one of the two voltage ranges.

(i) Set the DC output to 5.000 V, and adjust C101 again until the frequency is 23.0000 MHz. When compensation is made to the voltage range between 1 and 5 V, set the DC output to 9.000 V, and adjust the voltage-frequency gain response in the range which has not been subject to compensation (when compensation was made to the voltage range between 5 and 9 V, set the DC output to 1.000 V). Adjust R88 until the frequency is 22.000 MHz (when the standard DC source is set at 1.000 V, set the frequency to 24.0000 MHz).

(j) Adjust the voltage-frequency gain response in the range subject to compensation. Set the output of the standard DC source to 1.000 V, and adjust R92 until the frequency is 24.0000 MHz (or set the voltage source to 9.000 V, and adjust R99 until the frequency is 23.0000 MHz).

(k) While increasing the DC output from 1 to 9 V at 0.5 V steps (125 kHz steps), verify that the overall frequency variation ratio is less than 2%.

(l) If the error without compensation is less than 2%, leave the two jumper wires detached.

(m) Disconnect the DC source from the 3RDA S. IN and restore the original connection. Remount the shield case cover on the VCO block.

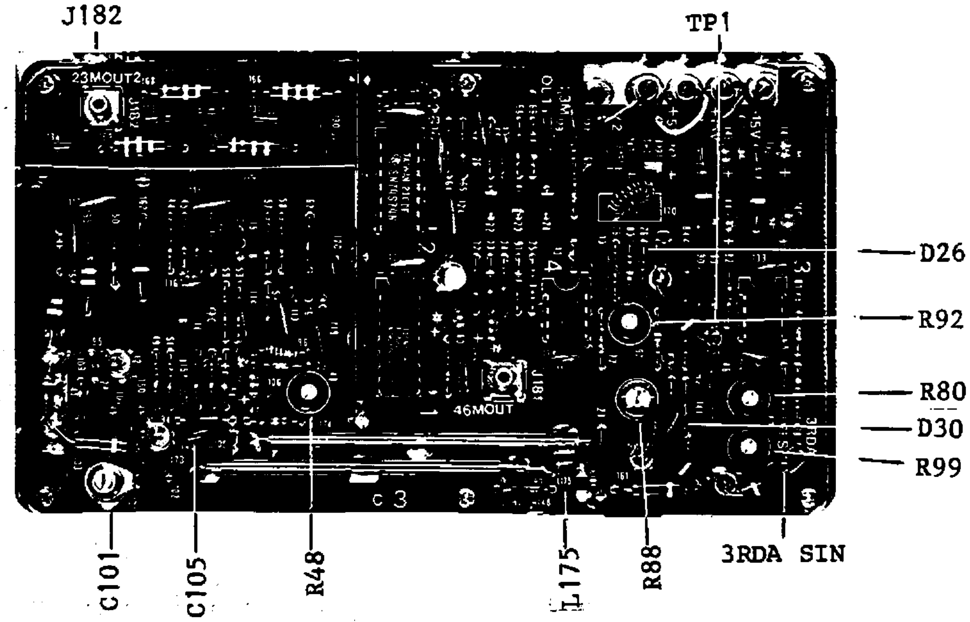


Fig. 11-62 Location of adjustments on the 23 MHz VCO (BLC-010101)

(2) 2 MHz VCO voltage-frequency gain adjustment and frequency variation adjustment

Adjustment of the 2 MHz VCO is similar to that for the 23 MHz VCO described above.

(a) Remove the shield case cover from the 2 MHz VCO block. Disconnect the input connection to the 3RD B S IN, and connect the DC output. Set the output to 5.000 V. Remove the two jumper wires (at D36 and D40) from the board.

(b) Check the voltage at TP-1, and adjust R91 until the voltage is 0.00 V.

(c) Check the voltage across C115 and GND, and adjust R58 until the voltage is -8.0 V.

(d) Set C111 to the center position. Connect the frequency counter to J191 on the board.

(e) Adjust the length of L185 until the counter readout is about 2.00 MHz. Make finer adjustment with C111 until the frequency reads exactly 2.0000 MHz.

(f) While increasing the DC output from 3 to 7 V at 1 V intervals, adjust R99 so the frequency increases at 25 kHz intervals.

(g) Search for the varicap offset voltage (normally 8 V $\pm$0.5 V) which gives the optimum frequency variation ratio, by adjusting R58. The desirable frequency variation error is less than 2%.

(h) When compensation is desired between 5 and 9 V, install the jumper wire on D40; when compensation is desired between 1 and 5 V, install the jumper wire for D36. It is preferred that compensation be made to only one of the voltage ranges.

(i) Set the output of the DC source to 5.000 V, and adjust C111 again until the frequency is 2.0000 MHz.

(j) Adjust the voltage-frequency gain response for the uncompensated portion with R99. When compensation is made between 5 and 9 V, adjust R212; when compensation is made between 1 and 5 V, adjust R108. Verify that a voltage variation from 1 to 9 V causes a frequency variation from 2.1000 to 1.9000 MHz, and the overall frequency variation error is less than 2%.

(k) If the error is less than 2% without compensation, the two jumper wires should be removed from the board.

(l) Disconnect the voltage source from the 3RD B S IN, and restore the original connection. Remount the shield case cover on the VCO block.

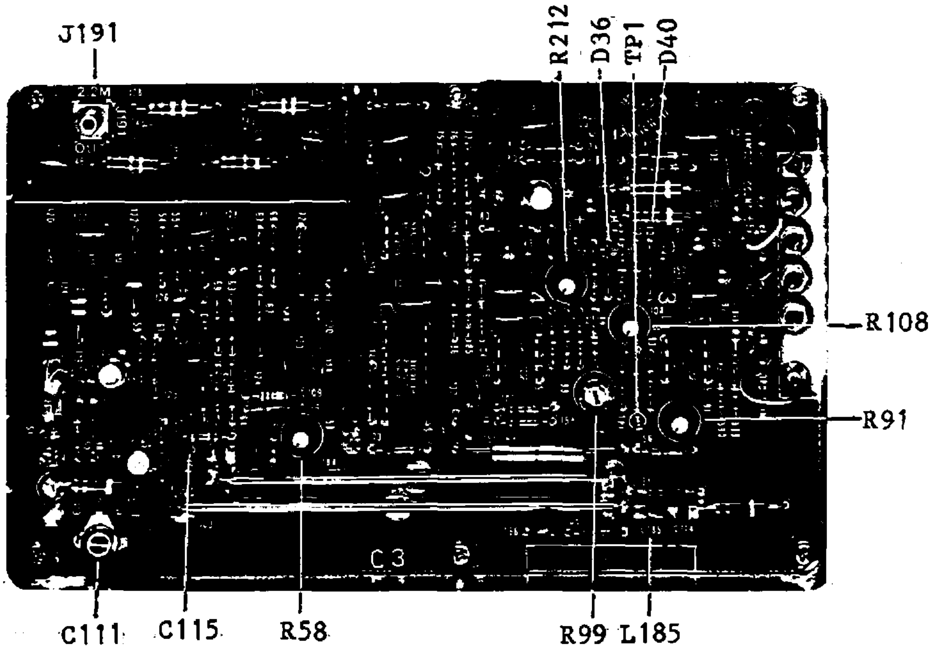


Fig. 11-63 Location of adjustments on the 2 MHz VCO (BLC-010102)

(3) 39 MHz mixer oscillator and B.P.F. adjustment

(a) Remove the shield case cover from the 39 MHz mixer block. Connect the external spectrum analyzer to J91 to observe the 39 MHz quartz oscillator output leaking from the mixer. The leakage level should be approximately -40 dBm.

(b) While monitoring the level of the 39 MHz signal, gradually turn the L71 slug until the signal level is 0.5 dB below the original level.

(c) Connect the signal generator output to J91. Set up the generator for a frequency of about 2 MHz $\pm$500 kHz, and a 0 dBm level. Connect the external spectrum analyzer to J92, and observe the 41 MHz output signal. The output level should be approximately -10 dBm.

(d) While varying the output frequency of the signal generator, observe the response of the 41 MHz B.P.F. with the external spectrum analyzer. Adjust C48, C51, C55, and C58 until the output level variation is less than 0.2 dB in the frequency range of 41 MHz $\pm$100 kHz, and the response is centered on that frequency. (See Figure 11-64.)

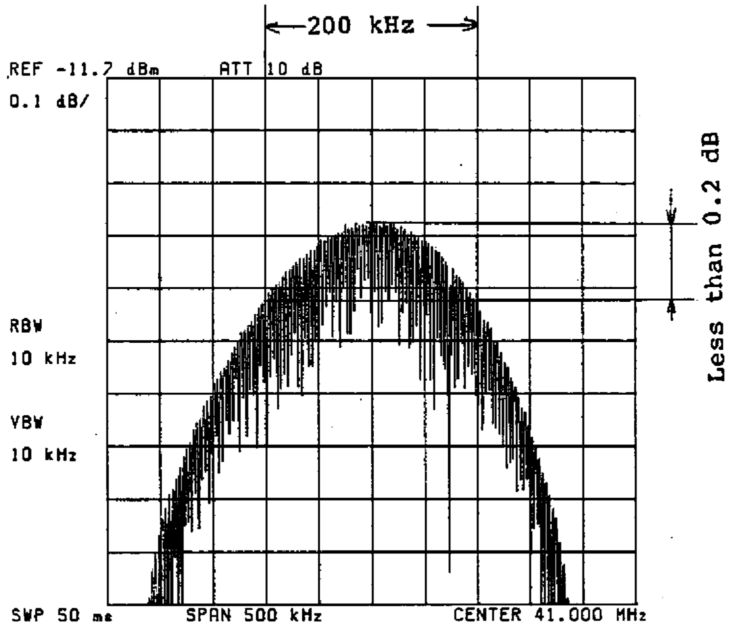


Fig. 11-64 41 MHz B.P.F. adjustment

(e) The output level at J92 should be less than -10 dBm $\pm$0.5 dB at 41 MHz. The output level and B.P.F. bandwidth are affected by the distances between L72 and L73, and L74 and L75. Adjust these distances.

(f) Restore the original connections for J91 and J92, and remount the shield case cover on the mixer block.

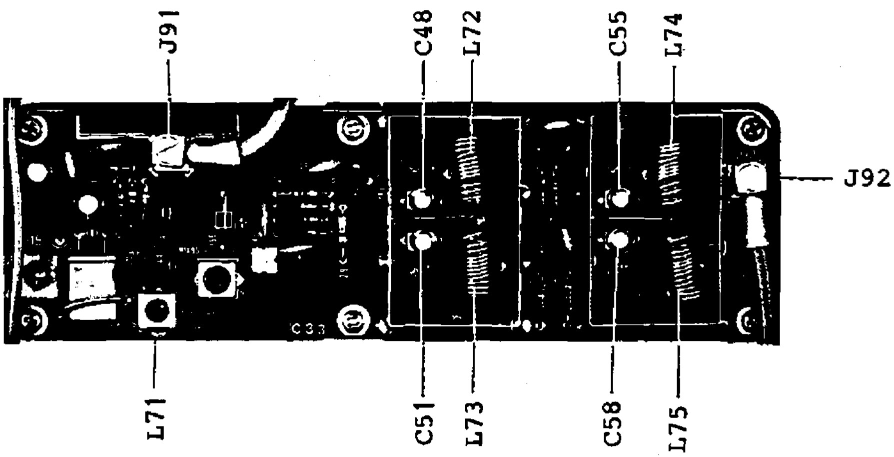


Fig. 11-65 Locations of adjustments on the 39 MHz mixer (BLC-010100)

(4) 176 MHz mixer oscillator and B.P.F. adjustment

Whenever resoldering is required for circuit components, be sure to set the POWER switch to STANDBY.

(a) Remove the shield case cover from the 176 MHz mixer. Disconnect the wiring to the COUN OUT and ON/OFF. Connect the standard DC output (+15 V) to ON/OFF, and connect the external spectrum analyzer to the COUN OUT. Set up the external analyzer for a center frequency of 153.3 MHz.

(b) While monitoring the level of the 153.3 MHz quartz oscillator output with the external spectrum analyzer, adjust C84 to position the level at 0.2 dB below the oscillation starting point as shown in the following figure.

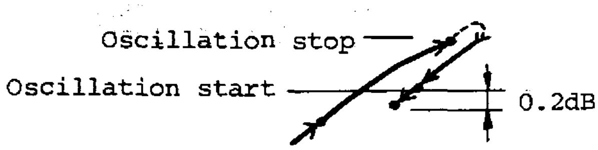


Fig. 11-66 153.3 MHz quartz oscillator adjustment

(c) Adjust L134 coil pitch so the maximum 153.3 MHz signal level is attained.

(d) Adjust the distance between L132 and L133 so the 153.3 MHz signal level is +2 dBm. Adjust only, L133 leaving L132 as it is.

(e) Connect the output of the signal generator to J161. Set up the signal generator output for a frequency of about 23 ±1 MHz and level of around -10 dBm. Disconnect the wiring from the RF OUT on the board, and connect the external spectrum analyzer. Since the output level at RF OUT is approximately +9 dBm, use the input attenuator in the external analyzer to prevent input overload. Set up the external analyzer for a center frequency of 176.3 MHz.

(f) While varyfing the output frequency of the signal generator, observe the response of the 176 MHz B.P.F. Adjust F166 and F167 so the output level variation is less than 0.5 dB in the frequency range of 176.33 ±1 MHz, with the filter response symmetrical around the center frequency and the output level maximized. Adjust the peak level with C112.

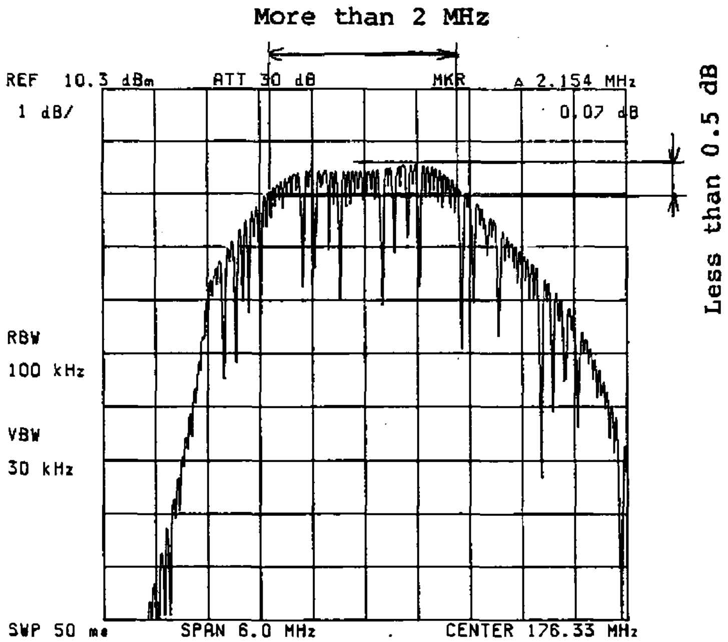


Fig. 11-67 176 MHz B.P.F. adjustment

(g) Verify that the output level is approximately +9 dBm ±1 dB at 176.33 MHz.

(h) Restore the original wiring and connections to the COUN OUT, ON/STANDBY, RF OUT, and J161, then remount the shield case cover on the 176 MHz mixer.

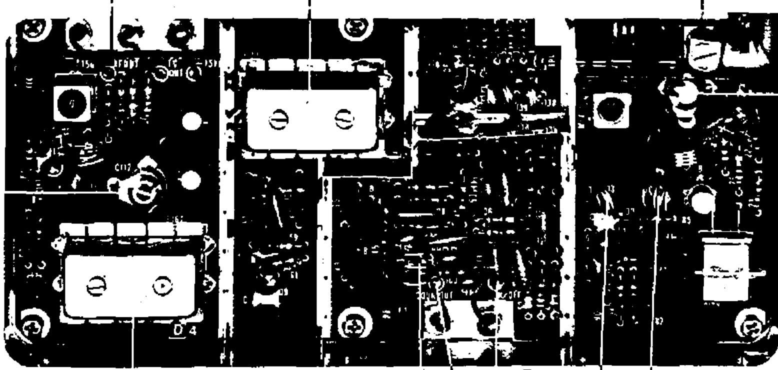


Fig. 11-68 Location of adjustments on the 176 MHz mixer (BLC-010099)

11-6-10. 1st Local PLL Block Adjustment (MEP-348 circuit diagram No. 64)

Block and circuit diagram Nos.

100/101 MHz oscillator (BLC-010115) No. 67

100/101 MHz OSC PLL (BLB-010120) No. 72

ANALOG PHASE DETECTOR (BLB-010117) No. 69

DIGITAL PHASE DETECTOR (BLC-010118) No. 70

PLL filter (BLB-010119) No. 71

1st local PLL mixer (BLB-010116) No. 68

2-4 GHz local PULSE GENERATOR (BTB-010114) No. 66

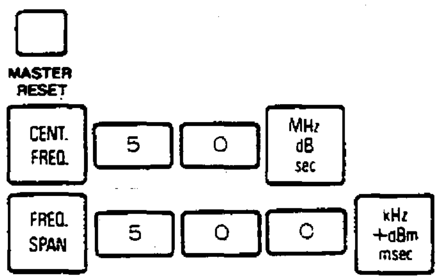
Isolation amplifier (BTB-010113) No. 65

Instruments required:
* Spectrum analyzer with tracking generater
* Standard DC voltage source
* High impedance probe
* Oscilloscope

(1) 100/101 MHz OSC PLL adjustment

(a) Remove the shield case cover from the 100/101 MHz OSC PLL block. Using the external spectrum analyzer with a high impedance probe attached, observe the signal response at the Q12 collector on the board. Set up the external analyzer for center frequency of 35 MHz.

(b) Set up the TR4172 as follows:



(c) Check the 35 MHz signal level with the external analyzer, and adjust L131, L132, and L133 until the maximum signal level is attained.

(d) Observe the signal response at the Q14 collector with the external analyzer. At this time, set up the external analyzer for a center frequency of 105 MHz. Adjust L134, C96, and C98 until the maximum 105 MHz signal level is attained.

(e) Remount the shield case over on the 100/101 MHz OSC PLL block.

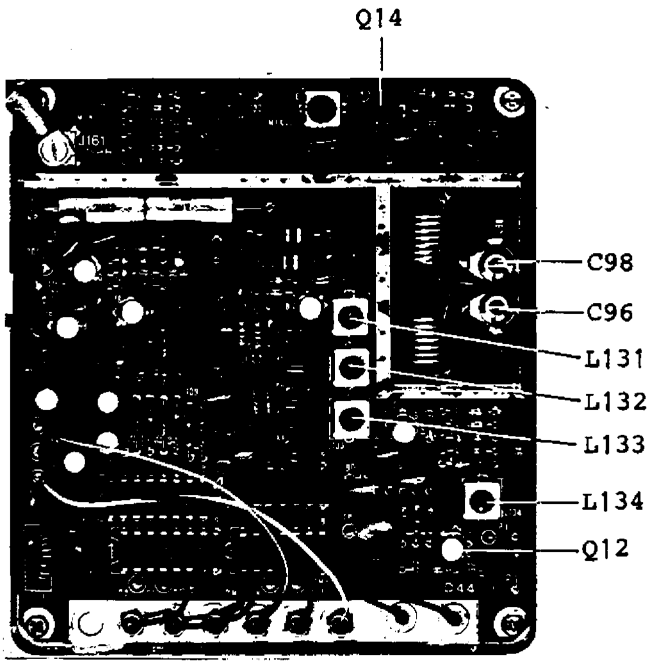


Fig. 11-69 Locations of adjustments on the 100/101 MHz OSC. PLL (BLB-010120)

(2) 100/101 MHz OSC adjustment

(a) Remove the shield case cover from the 100/101 MHz OSC block. Set the POWER switch to STANDBY, disconnect the wiring from the 100/101 MHz PLL IN terminal, and connect the standard DC output to the terminal. Set the output to approx 9.7V

(b) Set the POWER switch to ON, and set up the TR4172 as follows:

[CENT. FREQ] [5] [0] [MHz dB sec]

[FREQ. SPAN] [5] [0] [0] [kHz +dBm msec]

(101 MHz Oscillator oscillates)

(c) Connect the external spectrum analyzer to J116 and observe the output signal response. Since the output at J116 is 101 MHz in frequency and +23 dBm in level, use the input attenuator of the external attenuator to prevent input overload.

(d) Adjust C82, C87, and C88 until the 101 MHz signal level is maximized. Repeat this adjustment several times as C87 and C88 affect each other.

(e) Press [CENT. FREQ] [7] [9] [MHz dB sec] to activate the 100 MHz oscilator. Verify that the difference in the output signal levels (at J116) at 100 and 101 MHz is no more than 1 dB. If the difference is more than 1 dB, adjust C82, C87, and C88 again.

(f) Set the POWER switch to STANDBY. Restore the original wiring to the 100/101 MHz PLL IN terminal and J116.

(g) Set the POWER switch to ON, and warm up the instrument for at least 10 minutes. Set up the TR4172 as in step (b) to activate the 101 MHz oscillator and phase lock.

(h) Check the voltage across TP-1 and GND, and adjust X112 until the the voltage is +3.5 V.

(i) Press [CENT. FREQ] [7] [9] [MHz dB sec] to activate the 100 MHz oscillator and phase lock.

(j) Check the voltage across TP-1 and GND, and adjust X111 to obtain +3.5 V

(k) Remount the shield case cover on the 100/101 MHz OSC block.

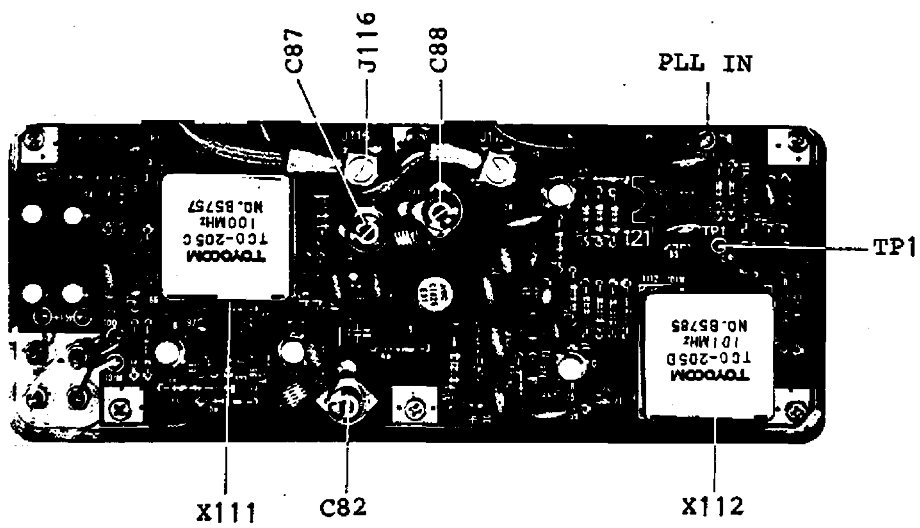
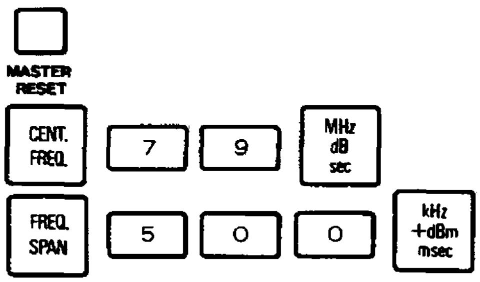


Fig. 11-70 Locations of adjustments on the 100/101 MHz OSC (BLL-010115)
(Circuit diagram No. 67)

(3) 2-4 GHz Pulse Generator (BTB-010114) adjustment

(b) Disconnect the wiring from J69 (first local PLL P.G. output) on MEP-348, and instead, connect the external spectrum analyzer to this terminal. Set up the external analyzer for direct observation of the frequency range between 2 GHz and 4 GHz. Since the signal level at J69 is considerably high, use the input attenuator in the external analyzer to prevent input overload.

(b) Set up the TR4172 as follows:



(c) The above setup activates the 100 MHz comb signal. Adjust R13, C24, and C25 so the comb signal level is more than -25 dBm in the 2-4 GHz frequency range. The comb signal spectrum within this frequency range should have minimum dip.

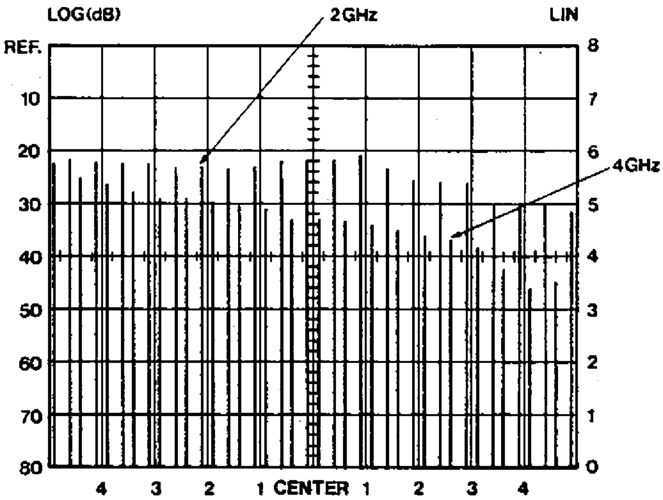


Fig. 11-71 Comb signal adjustment

(d) Press [CENT. FREQ] [5] [0] [MHz dB sec] to activate the 101 MHz comb signal. Verify that the comb signal level is more than -25 dBm in the 2.02-4.04 GHz frequency range.

(e) Restore the original wiring to J69 on MEP-348.

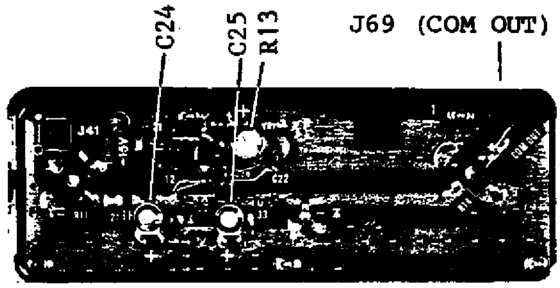


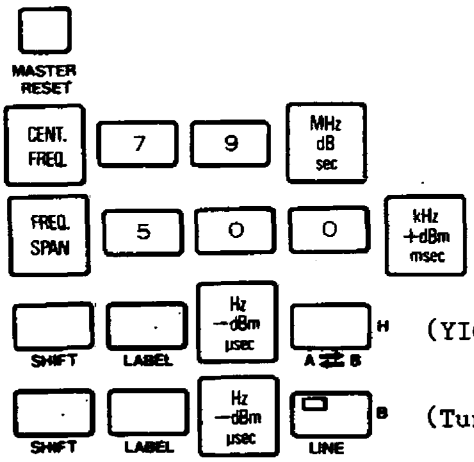
Fig. 11-72 Locations of adjustments on the 2-4 GHz
Pulse Generator (BTB-010114)

(4) Analog phase detector and PLL filter adjustment (BLB-010117
BLB-010119)

Whenever resoldering is required for a circuit component, be sure to switch off the instrument.

(a) Remove the shield case cover from the Analog phase detector and PLL filter block. Disconnect the wiring from the PLL OUT terminal on the PLL Filter board.

(b) Using the external spectrum analyzer with a high impedance probe attached, observe the signal response at the Q16 source on the Analog phase detector board. Update the panel setup for the TR4172:



(YIG LOCK 2 OFF)

(Tune FM Data (YIG I/O))

(c) Adjust the DATA knob to change Step FM setting, and observe the beat signal response with an oscilloscope.

(d) Confirm that the YTO beat signal is ±0.6 V with the center voltage of 0 V.

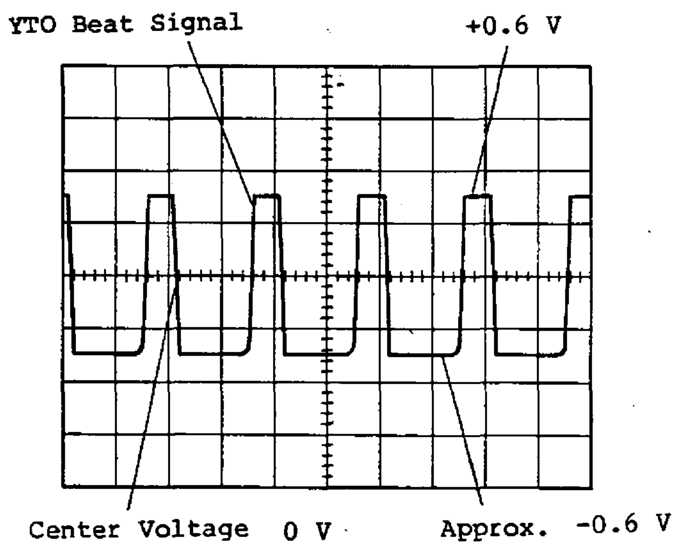


Fig. 11-73 Beat signal offset adjustment

(e) Press MASTER RESET switch. Disconnect the wiring from the D. IN and A. IN terminals on the PLL filter board. Connect the output of the tracking generator contained in the external spectrum analyzer to the D. IN terminal, and observe the signal response at D. OUT with the external analyzer. Set the tracking generator output level to about -10 dBm.

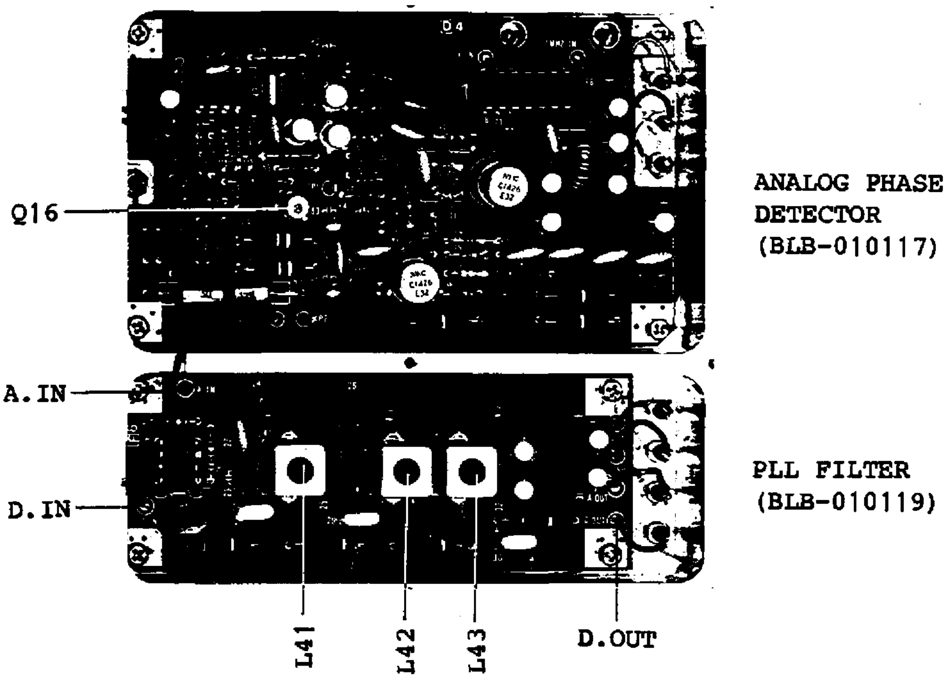


Fig. 11-74 Location of adjustments on the Analog phase detecter board (BLB-010117) and the PLL filter board (BLB-010119)

(f) Observe the PLL filter response of 0-5 MHz. Confirm that the cutoff frequency is 200 kHz.

(g) Connect the tracking generator output (of the external analyzer) to the A. IN terminal to observe the frequency band between 0 and 5 MHz. Adjust L42 until the trap frequency is 1 MHz. Adjust L41 until the trap frequency is 2 MHz.

Adjust L43 until the trap frequency is 500kHz

(b) Restore the original wiring to terminals D. IN and A. IN. Remount the shield case cover on the A phase detector and PLL filter block.

	Block	Test point and adjustment			Adjustment item and specifications
1	Display section power supply (BGP-010198)	TP-1 TP-2 TP-3 TP-4 TP-5	R33 R63 R50 R58 R44		+5 V ±0.05 V +135 V ±0.2 V -15 V ±0.01 V +25 V ±0.01 V +15 V ±0.01 V
2	High voltage power supply (BLC-010-204)	TP-K Anode 	R62 R64 R63		-3.000 kV +12 kV to +13 kV Intensity adjustment Focus adjustment
3	CRT Driver (BGK-010184)	J182 J182 GAIN POSI. GAIN POSI. 	pin 1 pin 5 C261 	R203 R199 R202 R200 R193 R192 R195 R194 R196 R201 R197 R198 C248	+75 V +75 V Halation adjustment Pattern distortion adjustment Y-axis adjustment X-axis adjustment Intensity adjustment Asting adjustment Focus adjustment (center) Focus adjustment (both sides) Z-axis response adjustment
4	Memory (BGP-010192)	TP-2 TP-4		R125 R126	DATA knob adjustment
5	D/A Converter (BGP-010188)	Q61	emitter	R91	+10 V ±10 mV
6	RAMP. GENERATOR (BGP-010185)	P1-9AB R64, 	 R65, 	R95 R83 R124 R130	0 V ±5 V (Ramp output voltage adjustment) Scan time accuracy adjustment Analog sweep adjustment Rewriting position adjustment
7	ANALOG I/O (BPG-010186)	 R164, R147, Y-axis gain Y-axis position X-axis gain X-aixs position C354, R293, 	R315, R130, R158, R150, R190, R183, C375, R306 R174	R311 R134 R156 R153 R188 R180 R240 R236 R254 R256 C363 	Offset null adjustment Log. Mag. Amp. adjustment Phase Mag. Amp. adjustment Horizontal scale adjustment Vertical scale adjustment Character adjustment Line generator adjustment Marker adjustment Analog sweep positional adjustment

	Block	Test point and adjustment	Adjustment item and specifications
8	A/D Converter (BGP-010187)	TP-4 R177 TP-4 R178 TP-4 R176 R179, R180 R175 R181	Sample detector adjustment Positive detector adjustment Negative detector adjustment Y-axis A/D converter adjustment Slope detector adjustment X-axis A/D converter adjustment
9	LOG AMP (BLP-010231)	L679, L672 R212, R145 R238, R301, R355 R157 R335 R352, R294 R254, R263, R272	3.3 MHz filter adjustment BW switching level adjustment Log linearity and gain adjustment DC offset adjustment Linear adjustment Linear step amp. adjustment
10	IF -1 (BLP-010229)	C372, C376, C380 L592, L594 First stage L601, C422 Second stage L604, C438 Third stage L607, C454 C484, C506, C529 C552 C482, C505, C528 C551 C486, C509, C532 C555 10 dB R136 20 dB R137 R127 B.W. 10 kHz R205 B.W. 3 kHz R235 B.W. 10 Hz R319	1 MHz B.P.F. adjustment LC filter adjustment Crystal filter frequency adjustment Crystal filter balance adjustment Crystal filter frequency adjustment Step amp. adjustment Total gain adjustment Inter-bandwidth level difference adjustment
11	IF -2 (BLP-010230)	First stage L514, C394 Second stage L522, C457 C421, C424 C420 C702, C696, C681 30 dB R139 40 dB R140 50 dB R220 1 dB R172 2 dB R164 4 dB R156 8 dB R148	LC filter adjustment Crystal filter frequency adjustment Crystal filter balance frequency Crystal filter 7 Hz adjustment Step amp. adjustment 1 dB step attenuator adjustment

	Block	Test point and adjustment		Adjustment item and specifications
11	IF-2 (BLP-010230)	B.W. 10 kHz B.W. 3 kHz B.W. 10 Hz B.W. 7 Hz	R317 R261 R263 R669	Inter-bandwidth level difference adjustment
12	PHASE and GROUP DELAY (BLP-010205)	TP-2	R292	Offset null adjustment
		TP-2	R295	+10 V adjustment
		TP-4	R301	Ref. adjustment
		TP-6	R297	Control voltage adjustment
		TP-5	R307	Offset null adjustment
		C422, C386,	C425 C391	3.3 MHz filter adjustment
		C351,	C505	33.3 MHz filter adjustment
		C371,	C506	30 MHz filter adjustment
		R273,	R265	Output level adjustment
			R281	Group delay offset adjustment
			R285	Group delay offset fine adjustment
			R283	Phase offset adjustment
13	RF power supply (BLF-010370)	TP-1	R33	−15 V ±0.01 V
		TP-2		+12 V
		TP-3	R39	+15 V ±0.01 V
		TP-4	R47	+5 V ±0.01 V
		TP-5		GND
14	50 MHz STD (BLB-010135)	L121, L122, L123, L124, L125, L126		50 MHz tuning adjustment
			R61	Output level adjustment
15	ATT I/O (BGN-010220)		R165	Offset adjustment
			R96	Frequency response compensation gain adjustment
16	YIG I/O (BGN-010219)	TP-4	R99	Offset null adjustment
		TP-4	R100	+10 V adjustment
		TP-1	R95	YIG main D/A adjustment
		TP-2	R94	YIG FM D/A adjustment
			R93	YIG main gain adjustment
			R98	YIG main span accuracy adjustment
			R101	Overall span accuracy adjustment
17	YIG Driver (BLC-010224)	R53,	R46	Offset null adjustment
			R42	YIG main offset adjustment
			R64	YIG FM gain adjustment
			R59	YIG FM span accuracy adjustment
18	3rd LO I/O (BGN-010221)	TP-4	R97	+10 V adjustment
		TP-1	R90	Tune D/A A adjustment
		TP-2	R96	Tune D/A B adjustment
		TP-3	R98	Tune D/A C adjustment
		R87, R88,	R89	Sweep gain A adjustment
			R85	Sweep offset A adjustment

	Block	Test point and adjustment	Adjustment item and specifications
18	3rd LO I/O (BGN-010221)	R94, R93, R95 R91 R86 R92	Sweep gain B adjustment Sweep offset B adjustment 20 MHz VCO span accuracy adjustment 2 MHz VCO span accuracy adjustment
19	Counter (BLJ-010131)	TP-1 R80 R75	-1.8 V adjustment Schmitt trigger sensitivity adjustment
20	RF (BLP-010133)	C237 C239, C240, C253 C254, C255, C264 L430, L432, C433 C375 C304 C292, C293, C294 C295, C296, C297 C310, C312 C342, C343, C344 C338, C339, C340 C341 R221 R151	204 MHz OSC adjustment Second local adjustment Fourth local adjustment Third local amp. adjustment 206 MHz B.P.F. adjustment 30 MHz B.P.F. (1) adjustment 30 MHz B.P.F. (2) adjustment 30 MHz B.P.F. (3) adjustment Inter-bandwidth level difference adjustment Total gain adjustment
21	TG-2 (BLJ-010129)	C156, C159 C162 C179, C183, C184 C185	30 MHz B.P.F. adjustment 206 MHz B.P.F. adjustment
22	TG-1 (BTF-010128)	C120 C104 R55	2046 MHz trap adjustment Frequency response compensation adjustment Output level adjustment
23	23 MHz VCO (BLC-010101)	R48 R99, R92 R88 R80 C101	Varicap offset voltage adjustment Linearity adjustment Voltage-frequency gain adjustment Offset voltage adjustment Oscillation frequency adjustment
24	2 MHz VCO (BLC-010102)	R58 R108, R212 R99 R91 C111	Varicap offset voltage adjustment Linearity adjustment V-f gain adjustment Offset voltage adjustment Oscillation frequency adjustment

	Block	Test point and adjustment	Adjustment item and specifications
25	39 MHz MIXER (BLC-010100)	L71 C48, C51, C55, C58	39 MHz OSC adjustment 41 MHz B.P.F. adjustment
26	176 MHz MIXER (BLC-010099)	C48 L134, L133 C112, F166, F167	153 MHz OSC adjustment 153 MHz level adjustment 176 MHz B.P.F. adjustment
27	100/101 MHz PLL (BLC-010120)	L131, L132, L133, L134, C96, C98	35 MHz tuning adjustment 105 MHz B.P.F. adjustment
28	100/101 MHz OSCILLATOR (BLC-010115)	C82, C87, C88 X111 X112	Level adjustment 100 MHz OSC adjustment 101 MHz OSC adjustment
29	2-4 GHz PULSE GENERATOR (BTB-010114)	R13, C24, C25	10 MHz Comb signal adjustment
30	PLL FILTER (BLB-010119)	L43 L42 L41	500 kHz trap adjustment 1 MHz trap adjustment 2 MHz trap adjustment

MEMO

SECTION 12

PERFORMANCE TEST

12-1. GENERAL

This section describes the procedure for the performance test of TR4172 spectrum analyzer. Major performance can be checked by using the CAL. OUT. (Calibration Output) signal of TR4172.

12-2. PREPARATION AND GENERAL PRECAUTIONS

Instruments and tools required for performance test and calibration are listed in Table 12-1.

12-2-1. Tools and Instruments Required for Performance Test

Table 12-1 Tools and instruments required for performance test

Instrument	Specification	Recommended Model
(1) Synthesized signal generator:	Frequency range: 50 Hz to 1800 MHz Output level: +10 dBm to −30 dBm Output impedance: 50 Ω Output level flatness: ±0.5 dB Frequency modulation: Internal 1 kHz Modulation depth: 10% Must be usable as an external reference.	
(2) Signal generator:	Frequency range: 100 kHz to 1800 MHz Output level: +10 dBm to −30 dBm Output impedance: 50 Ω Output level flatness: ±0.5 dB Frequency accuracy: ±0.01%	

Table 12-1 Tools and instruments required for performance test (Cont'd)

Instrument	Specification	Recommended Model
(3) Low distortion signal generator (or ordinary signal generator plus low-pass filter may be used):	Frequency range: 100 kHz to 900 MHz 2nd harmonic: More than 70 dB of attenuation with respect to an output level of -10 dBm Output level: -10 dBm	
(4) RF power meter :	Frequency range: 100 kHz to 1800 MHz Sensitivity: -30 dBm to +20 dBm Accuracy: ±0.2 dB	
(5) Spectrum analyzer:	Frequency range: 100 kHz to 3.6 GHz	TR4110/4111A (ADVANTEST)
(6) Attenuator:	Frequency range: DC to 500 MHz Attenuation: 0 to 110 dB at 10 dB steps 0 to 11 dB at 1 dB step 0 to 1.1 dB at 0.1 dB step Accuracy: ±0.2 dB for 10 dB ±0.02 dB for 1 dB ±0.002 dB for 0.1 dB	
(7) High isolation power splitter:	Frequency range: 10 kHz to 500 MHz Loss: 6 dB Output isolation: More than 30 dB	
(8) Digital multimeter:	Maximum input voltage: 250 V	TR6841 (ADVANTEST)
(9) Slidac transformer:	Variable voltage range: 80 to 250 V	
(10) Stop watch		
(11) Scale		

Table 12-2 Tools and jigs required for performance test

Item	Stock No.	Remarks
Input cable	MI-02	BNC-BUC (Short)*
Interconnecting cable	MI-61	BNC-BNC (Long)*
Interconnecting cable	MC-37	BNC-SMA
Interconnecting cable	MM-14	SMA-SMA
Interconnecting cable	MC-36	BNC-UM
Interconnecting cable	MM-17	UM-UM
N (P) to BNC (J) conversion adapter	JUG201	JNG-20A/U*
UM to UM linear adapter		UM-QA-JJ
SMA to SMA adapter		HRM-501

Items marked with an asterisk (*) are standard supply accessories.

12-2-2. General Precautions

(1) The instrument should be powered from an electrical outlet supplying the correct local line voltage of 100, 120, or 220 Vac ±10% or 240 Vac $^{+4\%}_{-10\%}$ (50/60 Hz).

(2) Before plugging the instrument into an electrical outlet, be sure to check that the POWER switch is set in the OFF position.

(3) The ambient temperature under which calibration is to be performed should be between +20°C and +30°C, with relative humidity under 80%. The working ambient should be free from excessive dusts, vibration, or noise.

12-3. PERFORMANCE CHECK USING CAL.OUT and T.G. OUTPUT

12-3-1. General

This paragraph describes basic performance check procedures for the TR4172 Spectrum Analyzer using the calibration and tracking-generator outputs of the Analyzer itself.

12-3-2. Initialization

Place the Analyzer in the initial power-on default state. This state may also be entered by pressing [MASTER RESET] key on the front panel.

12-3-3. Auto Calibration

The instrument can perform an error correction routine for changing resolution bandwidth. Before proceeding with performance check, be sure to execute the error correction routine as described below.

Connect the CAL. OUT. connector to the INPUT-1 connector (both on the RF section). Press [SHIFT] [LABEL] [ ]W to initiate the error correction routine, in which level differences between each resolution bandwidth recorrected.

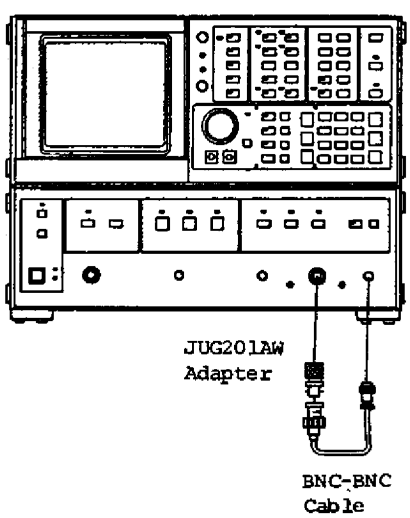
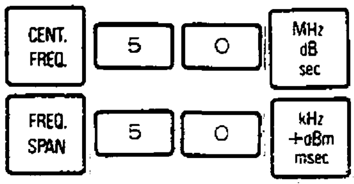


Fig. 12-1 Connecting the CAL.OUT. to INPUT-1

12-3-4. Impact Test

Specification: The instrument must operate normally after its front, rear, left side, and then right side is sequentially lifted to a height of 3 cm (with the opposite sides always resting on the test deck) then is dropped from this height on the deck.

(1) Make the following setup when the instrument is in the initial state.



(2) Lift the front, rear, left side, and then right side of the instrument sequentially to a height of 3 cm (with the opposite sides always resting on the test deck) and drop each side from this heigh on the deck. Verify that no abnormality nor change is observed in its display information, indicator lamps, and so forth after the drop test.

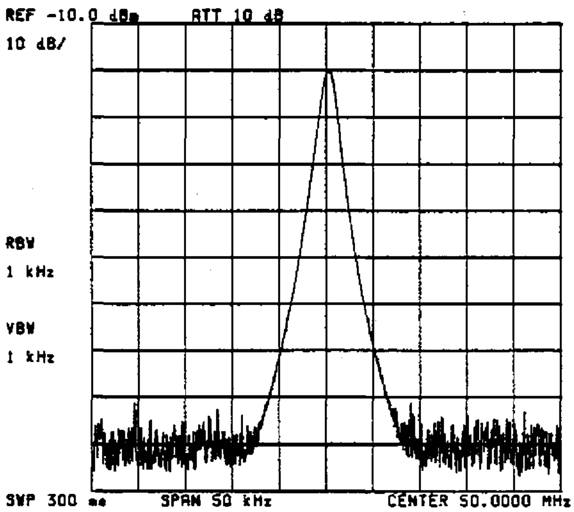
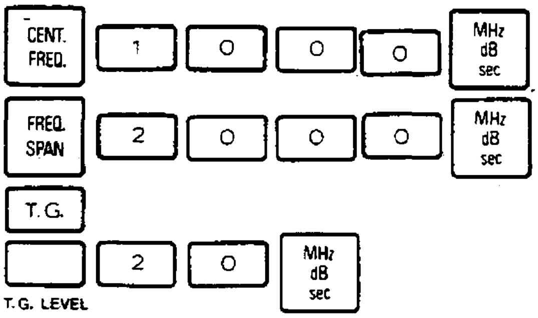


Fig. 12-2 CAL. OUT. signal response

(3) Next, connect the TRACKING GENERATOR OUTPUT connector to the INPUT-1 connector (both on the RF section), and set up the instrument as follows:



(4) Lift the front, rear, left side, and then right side of the instrument to a height of 3 cm (with the opposite sides always resting on the test deck) then drop each side on the deck from this height, and check to make sure that no abnormality or change is observed in the tracking generator output response shown on the display.

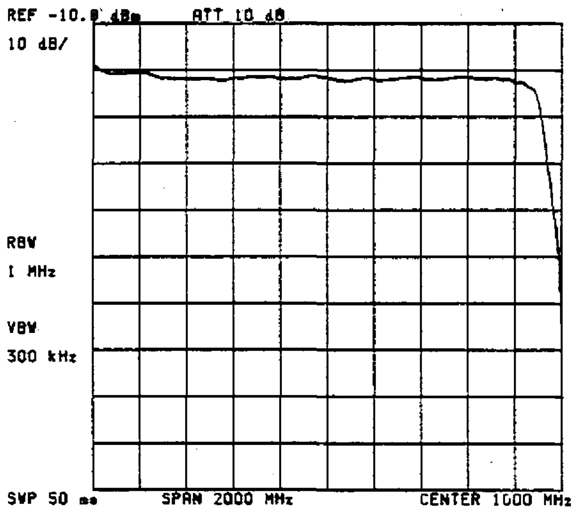


Fig. 12-3 Tracking generator output response

12-3-5. Display Area

Specification: The display area should measure 100 mm by 120 mm or more.

(1) Press the MASTER RESET key to return the instrument in the initial state. Press [LABEL] and arbitrary keys to show label information on the display.

(2) Check to make sure that the display area is more than 100 mm by 120 mm as shown in the following figure:

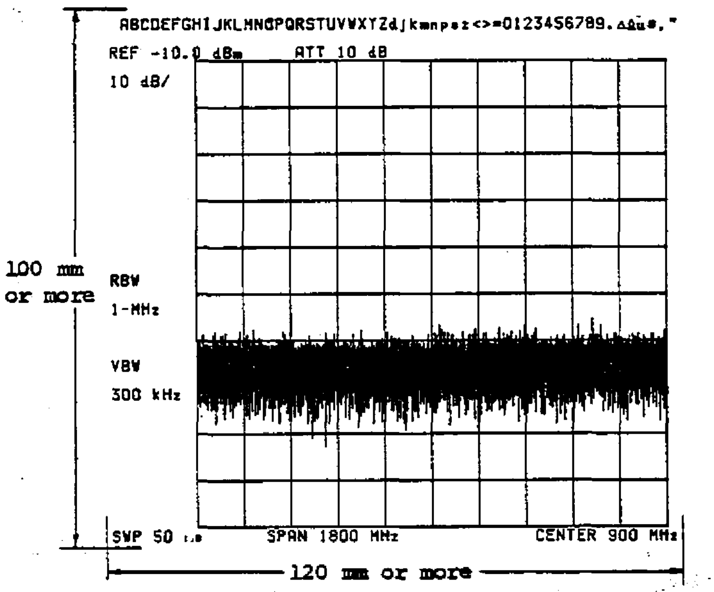


Fig. 12-4 Display area

12-3-6. CRT Raster and Orthogonality Distortion

Specification: Less than ± 1 mm

(1) While the instrument is in the initial state, check the raster edges against the graticule either visually or with a scale.

(2) Check to make sure that the barrel or pincushion distortion, if any, is less than 1 mm with respect to the standard pattern scale included in the maintenance kit.

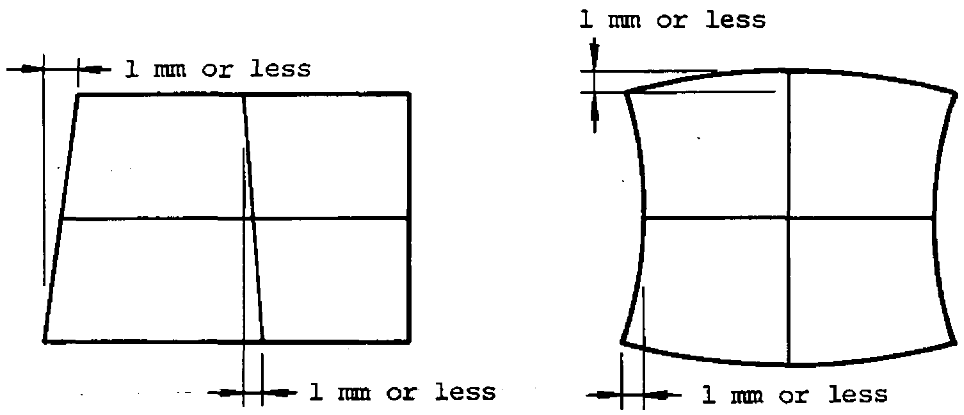
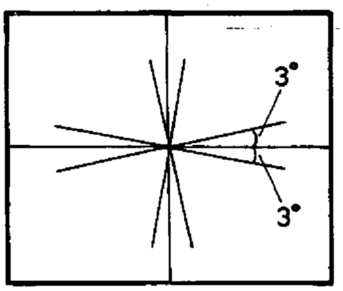


Fig. 12-5 CRT raster and orthogonality distortion

12-3-7. Trace Align

Specification: Variable over ± 3 degrees or more.

(1) While the instrument is in the initial state, check graticule either visually or with a scale.



* 3 degrees can be obtained by a gradient of 3 mm in 57 mm as shown below.

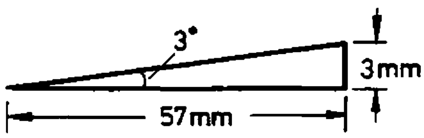


Fig. 12-6 Trace align

(2) After adjusting trace rotation to the normal state, check to make sure that it is variable over ± 3 degrees. The location of the adjustment is shown below:

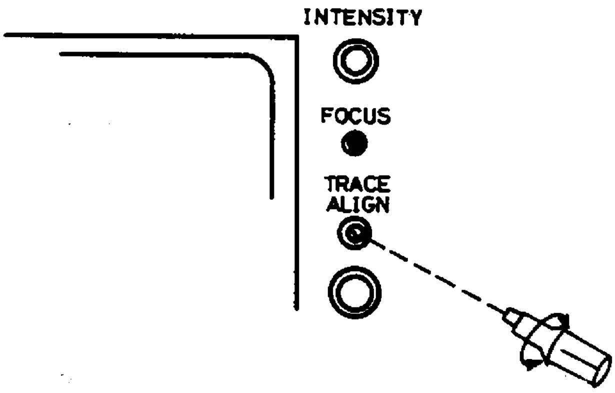


Fig. 12-7 Trace align adjustment

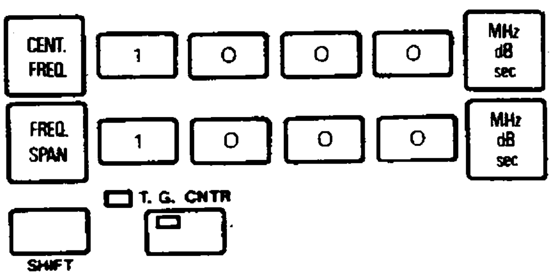
12-3-8. Intensity and Focus Alignment

Turn the INTENSITY control fully counterclockwise to make sure that the screen is completely blacked out. Gradually turn it clockwise and make sure that the display information starts dimly comes on when the control is around its center, and that display information can be observed at the maximum intensity but with no blur when the control is turned to the maximum (fully clockwise). Next, turn the FOCUS screwdriver adjustment to make sure that a correct and even focus is obtained over the entire screen.

12-3-9. Frequency Span Accuracy

Specification: Less than ±3% when frequency span > 500kHz
Less than ±5% when frequency span $\leqq$ 500kHz

(1) While the instrument is in the initial state, set it up as follows:



(2) Next, press [⇧] to position the marker to the rightmost graticule. Press [ ] (Δ) and then [⇩] to position the marker all the way to the leftmost graticule. The absolute value of the delta (Δ) marker frequency readout obtained at that time indicates the actual frequency span, which should be within 1000 MHz ±30 MHz (±3%). The YTO main tune accuracy can be known from this frequency span.

(3) Press [FREQ SPAN] [1] [0] [MHz dB sec] [ ] (Δ). An active marker is located on the leftmost graticule. Press [⇧] to reposition the marker all the way to the rightmost graticule. Compare the delta (Δ) marker frequency readout obtained at that time with the frequency span setting (10 MHz), and make sure that the readout is within 10 MHz ±0.5 MHz (±5%). The YTO FM tune accuracy can be known from this readout.

(4) Press [FREQ SPAN] [5] [0] [0] [kHz +dBm msec] [ ] (Δ). Then press [⇩] to position the marker to the leftmost graticule. Compare the delta (Δ) marker frequency readout obtained at that time with the frequency span setting (500 kHz), and make sure that the readout is within 500 kHz ±25 kHz (±5%). The accuracy of the 3rd local VCO (20 MHz) can be known from this result.

(5) Press [FREQ SPAN] [5] [0] [kHz +dBm msec] [ ] (Δ). Then press [⇧] to reposition the marker to the rightmost graticule. Compare the delta (Δ) marker readout obtained at that time with the frequency span setting (50 kHz), and make sure that the readout is within 50 kHz ±2.5 kHz (±5%). The accuracy of the 3rd local VCO (2 MHz) can be known from this result.

12-3-10. Marker Readout Accuracy in the Normal and T.G. Counter Mode

Specification: Normal: Center frequency accuracy plus Accuracy of frequency span between marker and center frequency)

T.G. Counter: Center frequency accuracy

(1) While the instrument is in the initial state, set it up as follows:
Connect the CAL. OUT. connector to the INPUT-1 connector (both on the RF section), then enter the following data:

$\boxed{\text{CENT. FREQ.}}$ $\boxed{1}$ $\boxed{0}$ $\boxed{0}$ $\boxed{0}$ $\boxed{\text{MHz dB sec}}$

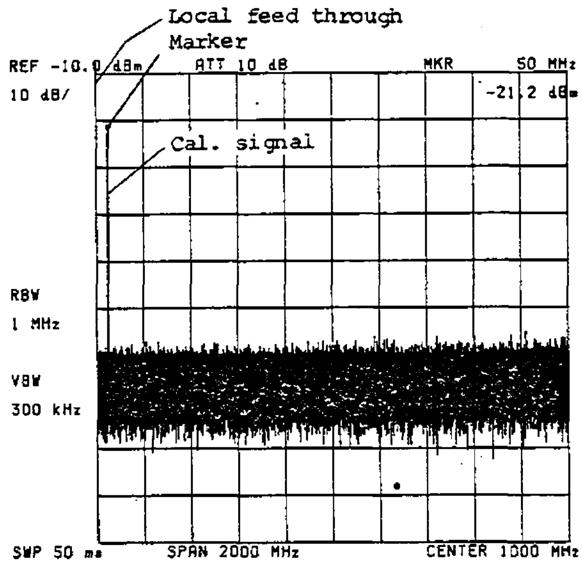
$\boxed{\text{FREQ. SPAN}}$ $\boxed{2}$ $\boxed{0}$ $\boxed{0}$ $\boxed{0}$ $\boxed{\text{MHz dB sec}}$

$\boxed{}$ MARKER

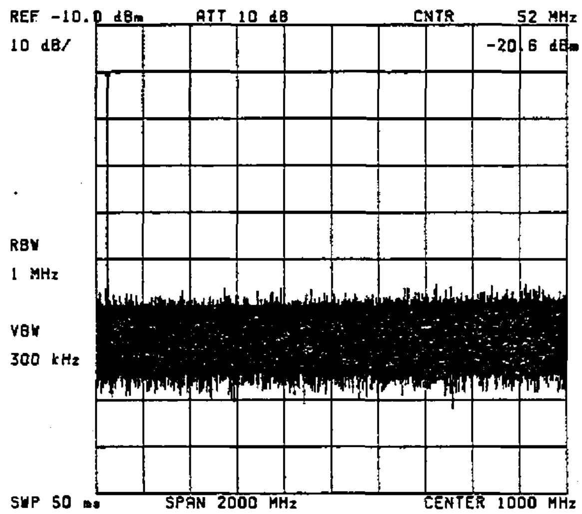
(2) Use $\boxed{\Downarrow}$ key and the DATA knob to position the marker to the peak of the CAL signal response. Read the marker frequency, and check to make sure that the readout is within the specification. The specification is: (center frequency accuracy) +(accuracy of frequency span between marker and center frequency), which is determined as 50 MHz $\pm$(2000 MHz x $\frac{1}{100}$ +20 Hz) $\pm$(1000 MHz − 50 MHz) x $\frac{3}{100}$ = 50 MHz $\pm$48.5 MHz.

(3) Next, press $\boxed{}$ SHIFT $\boxed{}$ T. G. CNTR to switch the marker in the T.G. counter mode

(4) Position the marker to the peak of the CAL signal response. Read the marker frequency, and check to make sure that the readout is within the specification. The specification is the same as the center frequency accuracy, which is 50 MHz $\pm$(2000 MHz x $\frac{1}{100}$ +20 Hz) = 50 MHz $\pm$20 MHz.



(1) Normal Marker Mode



(2) T.G. Counter Mode

Fig. 12-8 Marker readout accuracy in the Normal and T.G. Counter modes

12-3-11. Marker Readout Accuracy in the Counter Mode

Specification: Master oscillator accuracy x readout frequency ±2 counts when counting a spectrum frequency whose level is more than 25 dB above the average noise level.

(1) While the instrument is in the initial state, set it up as follows:

Connect the CAL. OUT. connector to the INPUT-1 connector, then key in the following data:

[CENT. FREQ.] [5] [0] [MHz dB sec]

[FREQ. SPAN] [1] [0] [MHz dB sec]

[RES. BW] [1] [MHz dB sec]

[VIDEO BW] [1] [kHz +dBm msec]

[FREQ. CNTR]

[SHIFT] [CNTR RESOLN] [1] [0] [Hz −dBm μsec]

[MARKER]

(2) Check to make sure that a marker frequency readout of 50.00000 MHz is obtained on the display when a signal response of more than 25 dB above the average noise level is indicated by the marker.

(3) Press [SHIFT] [CNTR RESOLN] [1] [Hz −dBm μsec] to set counter resolution to 1 Hz. If the readout is 50.000000 MHz, the tuned amplifier operation is assumed to be normal.

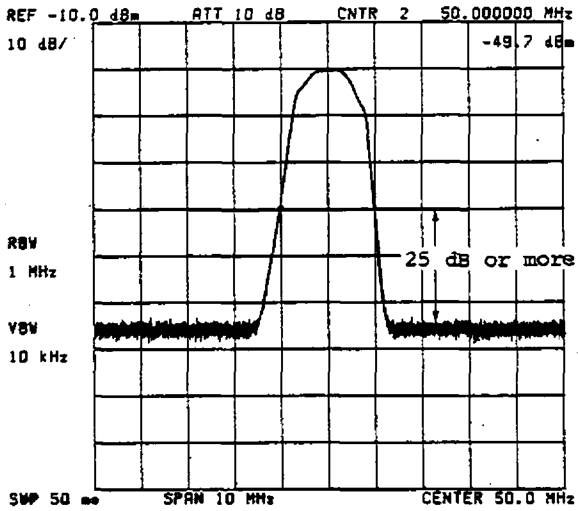
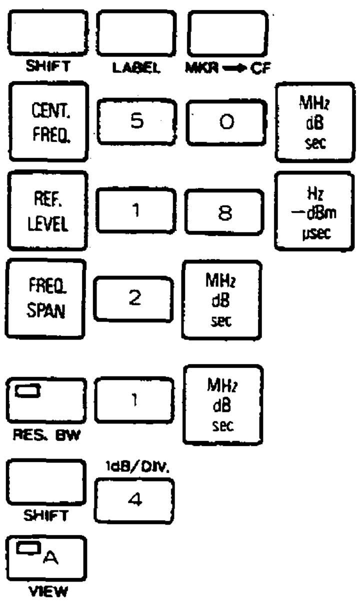


Fig. 12-9 Marker readout accuracy in the Counter mode

12-3-12. Resolution Bandwidth Accuracy

Specification: Within ±20% of each resolution bandwidth.

(1) While the instrument is in the initial state, set it up as follows:
Connect the CAL. OUT. connector to the INPUT-1 connector, then type in the following:



(Executes the error correction routine.)

(Stores the signal response trace.)

(2) Press [ ] PEAK SEARCH to indicate the peak with the marker. Then press [ ] Δ and reposition the marker to the Δ = -3 dB point on either side of the peak. Press [ ] Δ again and reposition the marker to the other Δ = -3 dB point on the opposite side of the peak.

The delta (Δ) marker frequency readout obtained at that time indicates the 3 dB bandwidth. Check to make sure that the bandwidth is within the 800 kHz to 1.2 MHz specification.

(3) Check the 3 dB bandwidths at each resolution bandwidth and frequency span selected with [FREQ. SPAN] and [ ] RES. BW keys. The resolution bandwidths, optimum frequency spans, and corresponding 3 dB bandwidth specifications are listed in the following table:

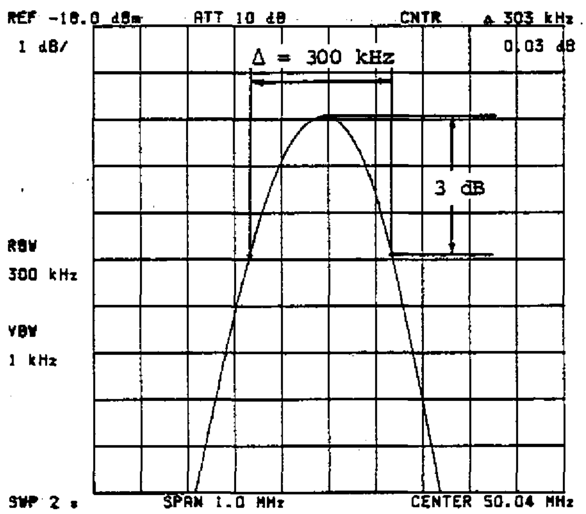


Fig. 12-10. Resolution Bandwidth Check

Table 12-3 Resolution bandwidths and optimum frequency spans

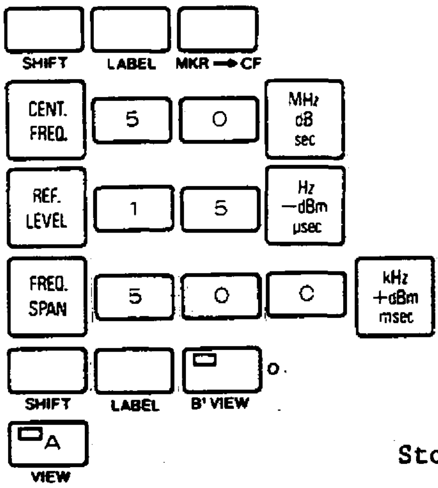
RES. BW	SPAN	Specification
1 MHz	2 MHz	800 kHz to 1.2 MHz
300 kHz	1 MHz	240 kHz to 360 kHz
100 kHz	200 kHz	80 kHz to 120 kHz
30 kHz	100 kHz	24 kHz to 36 kHz
10 kHz	20 kHz	8 kHz to 12 kHz
3 kHz	10 kHz	2.4 kHz to 3.6 kHz
1 kHz	2 kHz	800 Hz to 1.2 kHz
300 Hz	1 kHz	240 Hz to 360 Hz
100 Hz	200 Hz	80 Hz to 120 Hz
30 Hz	100 Hz	24 Hz to 36 Hz
10 Hz	100 Hz	8 Hz to 12 Hz

* For the resolution bandwidth accuracy check described in paragraphs 12-3-11 and 12-3-12, the vertical axis accuracy for 1 dB/div. and 10 dB/div. and the frequency span accuracy on the horizontal axis are both assumed to be calibrated to error zero. However, slight error in these axes wont'd raise any serious problems when performing the specification comformity check. For a more precision check, first calibrate the vertical scale for 1 dB/div. and 10 dB/div. according to paragraph 12-4-1, and use the delta marker in the T.G. Counter mode for frequency span measurement on the horizontal scale.

12-3-13. Resolution Bandwidth Accuracy for QP Measurement (with the QP Option only)

Specification: 6 dB bandwidth: 120 kHz ±20 kHz
9 kHz ±1 kHz
200 Hz ±20 Hz

(1) For the instrument with the QP Option, press MASTER RESET to return the instrument into the initial default state after the above resolution bandwidth check over 1 MHz through 10 Hz has been completed. Then set up the instrument for the following: Connect the CAL. OUT. connector to the INPUT-1 connector, then enter as follows:



(Error collection routine)

(QP MODE BW 120 kHz check)

Store the wave form. (freeze the trace)

(2) Now press PEAK SEARCH to capture the signal response peak. Then press Δ and position the marker to the Δ = −6 dB point on one side of the peak. Press Δ again and position the marker to the other −6 dB point on the opposite side of the peak, where Δ =0 dB. The delta marker readout at that time indicates the 6 dB bandwidth. Verify that it is within the specification.

(3) Similarly check the 9 kHz and 200 Hz bandwidths as well. The panel setup and optimum frequency spans for the 9 kHz and 200 Hz bandwidth check are shown in the following:

• For 9 kHz bandwidth:

[SHIFT] [LABEL] [B → B'] N   (QP MODE BW 9 kHz)

[FREQ. SPAN] [5] [0] [kHz +dBm msec]

• For 200 Hz bandwidth:

[SHIFT] [LABEL] [B − DL → B] M   (QP MODE BW 200 Hz)

[FREQ. SPAN] [1] [kHz +dBm msec]

If the QP mode bandwidth check mode is selected (e.g. by pressing [SHIFT] [LABEL] [B' VIEW] o) for the TR4172 Analyzer with no QP Option, the actual bandwidth won't be set up although message "QP BW CHECK" will be shown on the display.

12-3-14. Resolution Bandwidth Selectivity (60/3 dB bandwidth ratio)

Specification: Less than 10:1 at 1 MHz and 300 kHz.

Less than 13:1 over 100 kHz to 10 Hz.

(1) While the instrument is in the initial default state, set it up as follows:

Connect the CAL. OUT. connector to the INPUT-1 connector, then key in as follows:

[SHIFT] [LABEL] [MKR → CF] (Executes the error correction routine.)

[CENT. FREQ.] [5] [0] [MHz dB sec]

[FREQ. SPAN] [1] [0] [MHz dB sec]

[RES. BW] [1] [MHz dB sec]

[VIDEO BW] [3] [kHz +dBm msec]

[INPUT ATT.] [0] [MHz dB sec]

[PEAK SEARCH] [MKR → CF]

[A VIEW] (Stores the signal response trace.)

(2) Press [Δ] and position the marker to Δ = -60 dB point on either side of the signal peak. Press [Δ] again and reposition the marker to the other -60 dB point on the opposite side of the signal peak where Δ = 0 dB. The delta (Δ) marker frequency readout obtained at that time indicates the 60 dB bandwidth. Check to make sure that this bandwidth is less than 10 MHz (10:1).

(3) Check the selectivities at each frequency span, resolution bandwidth, and video bandwidth sequentially selected with [FREQ. SPAN], [RES. BW], and [VIDEO BW] keys. Table 12-4 shows resolution bandwidths, optimum frequency spans and video bandwidths, and corresponding selectivity specifications.

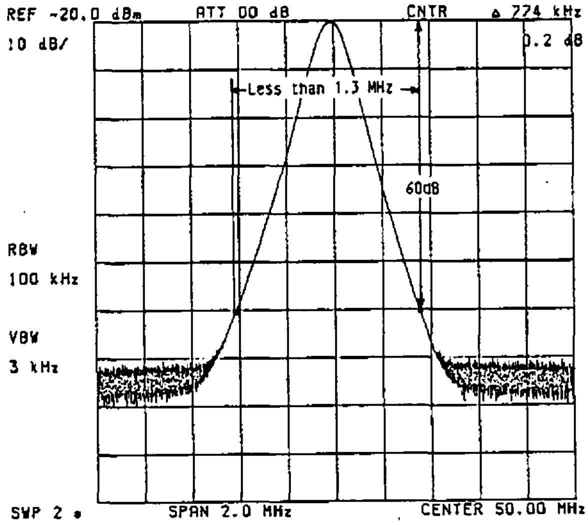


Fig. 12-11 Resolution Bandwidth Selectivity Test

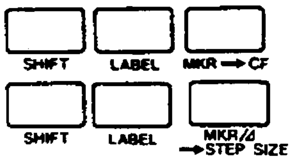
Table 12-4

RES. BW	SPAN	VIDEO BW	Specification
1 MHz	10 MHz	3 kHz	below 10 MHz
300 kHz	5 MHz	3 kHz	below 3 MHz
100 kHz	2 MHz	3 kHz	below 1.3 MHz
30 kHz	500 kHz	3 kHz	below 390 kHz
10 kHz	200 kHz	1 kHz	below 130 kHz
3 kHz	50 kHz	300 Hz	below 39 kHz
1 kHz	20 kHz	300 Hz	below 13 kHz
300 Hz	5 kHz	100 Hz	below 3.9 kHz
100 Hz	2 kHz	30 Hz	below 1.3 kHz
30 Hz	500 Hz	10 Hz	below 390 Hz
10 Hz	200 Hz	3 Hz	below 130 Hz

12-3-15. Resolution Bandwidth Switching Level Accuracy

Specification: Within ±1.0 dB with respect to the resolution bandwidth of 300 kHz before subject to error correction.

(1) While the instrument is in the initial default state, set it up as follows:
Connect the CAL. OUT. connector to the INPUT-1 connector, and key in as follows:



(Executes the error correction routine.)

(Lists the correction data.)

(2) Check to make sure that the level deviations at each resolution bandwidth is within 1.0 dB with respect to the level correction data at the resolution bandwidth of 300 kHz.

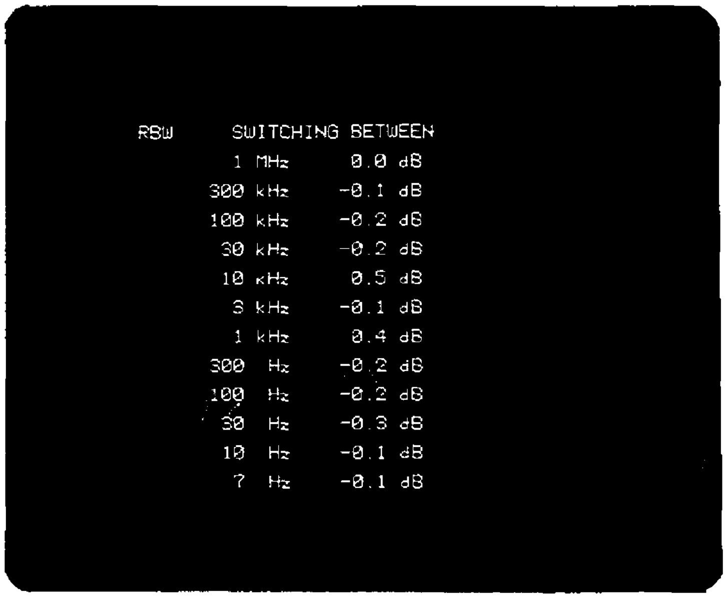
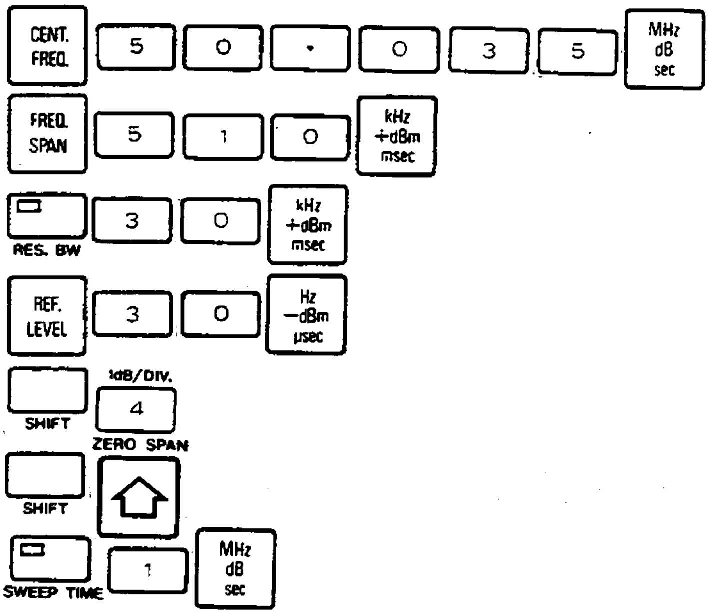


Fig. 12-12 Level correction data listing

12-3-16. Residual FM Component

Specification: 8 kHzp-p/sec. When frequency span $\geq$ 510 kHz
2 Hzp-p/sec. When frequency span $<$ 50 kHz

(1) While the instrument is in the initial default state, set it up as follows:
Connect the CAL. OUT. connector to the INPUT-1 connector, then key in as follows:



(2) The above setup activates an internal slope detection network using IF filters, which allows for observation of the residual FM component while the 1st local oscillator is unlocked. Read the frequency variation in one second from the response shown on the display, while bearing in mind that the vertical scale is 2 kHz/dB at a resolution bandwidth of 30 kHz. If the signal response trace out-scales begin to drift, etc., press CENT. FREQ. again and reposition the response in the center of the scale with the DATA knob.

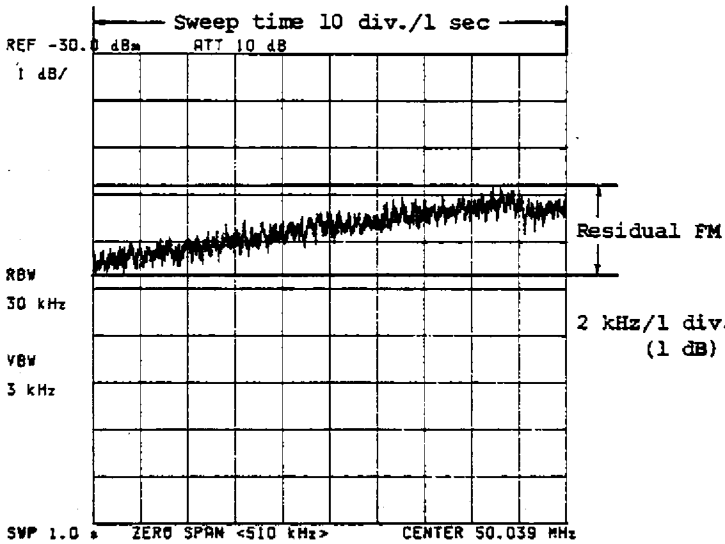
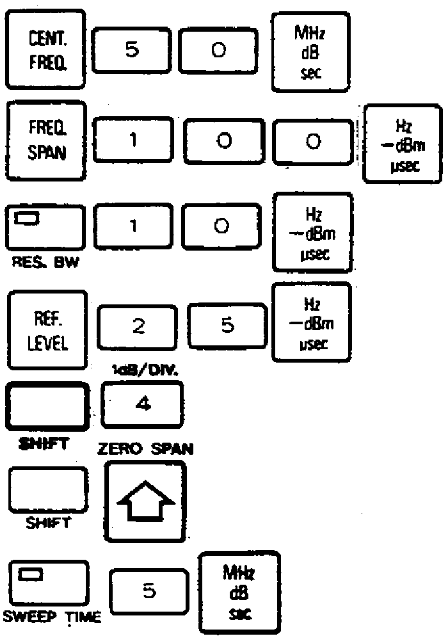


Fig. 12-13 Residual FM when the 1st local unlocked

(3) Press MASTER RESET to return the instrument into the initial default state, then set it up as follows:

Connect the CAL. OUT. connector to the INPUT-1 connector, then key in the following:



(4) The above setup activates the internal slope detection network using IF filters, which allows for observation of the residual FM component contained in the 2 MHz 3rd local VCO output. Read the frequency variation in one second (2 divisions on the horizontal axis) from the signal response on the vertical scale, while bearing in mind that the vertical scale is 1 Hz/dB at a resolution bandwidth of 10 Hz. If the signal response trace out-scales due to drift, etc, press [CENT. FREQ.] again and reposition the response in the center of the scale with the DATA knob.

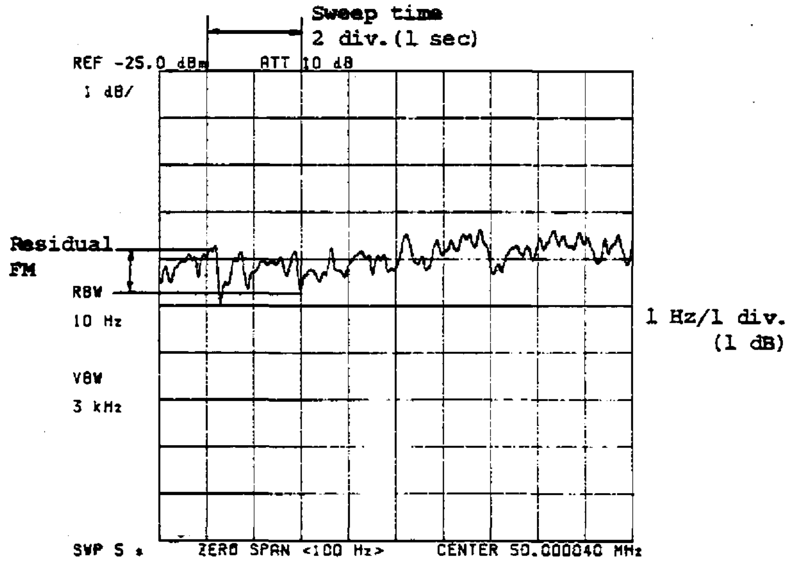
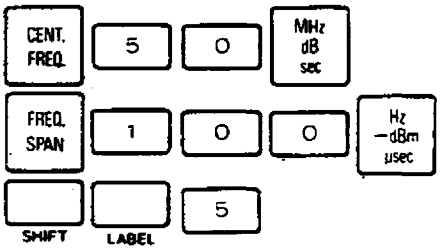


Fig. 12-14 Residual FM of the 3rd local 2 MHz VCO

12-3-17. Frequency Stability

Specification: 30 Hz p-p/min. when frequency span < 50 kHz (at a constant temperature after one hour of warm-up)

(1) While the instrument is in the initial default condition, set it up as follows:
Connect the CAL. OUT. connector to the INPUT-1 connector, then key in as follows:



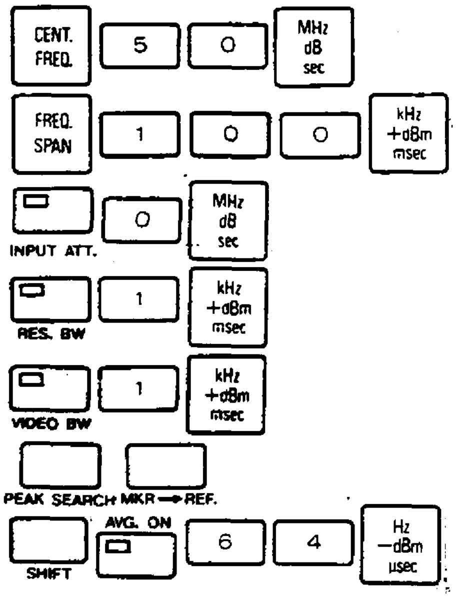
(Cuts off the routine that corrects the center frequency for each sweep.)

(2) Press [PEAK SEARCH] [Δ] and wait for one minute (12 sweep interval because a sweep time of 5 is selected in the above setup).
Press [PEAK SEARCH] again, which will show a frequency drift occurred in one minute, in the form of a delta (Δ) marker frequency.
Check to make sure that the frequency drift is less than 30 Hz/min.

12-3-18. Noise Sideband

Specification: Less than -80 dB/1 kHz BW at 30 kHz apart from the carrier
Less than -75 dB/1 kHz BW at 20 kHz apart from the carrier
(where video bandwidth: 1 Hz, resolution bandwidth: 1 kHz)

(1) While the instrument is in the initial default state, set it up as follows:
Connect the CAL. OUT. connector to the INPUT-1 connector, then key in as follows:



(Sets up the number of averages to 64.)

(2) After 64 repetitions of averaging are completed, press A VIEW to store the resulting signal response. Press PEAK SEARCH Δ, then use ⇧ ⇩ to read the average noise leves at Δf = ± 20 kHz and Δf = ± 30 kHz apart from the carrier peak, from the delta marker readout. These levels are sideband noise levels. Check to make sure that they are less than -75 dB and -80 dB respectively.

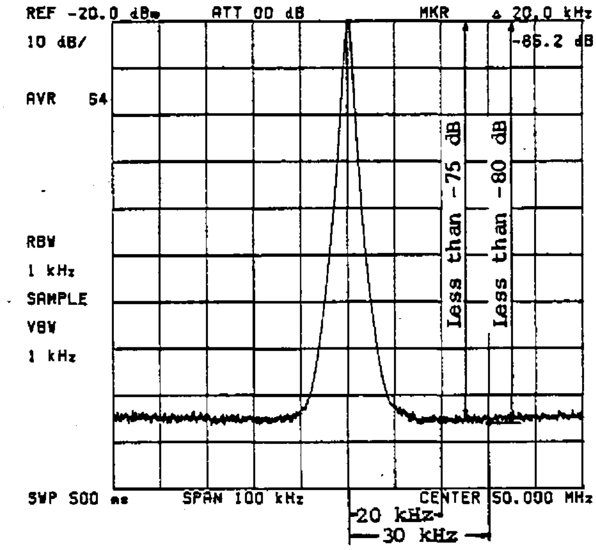


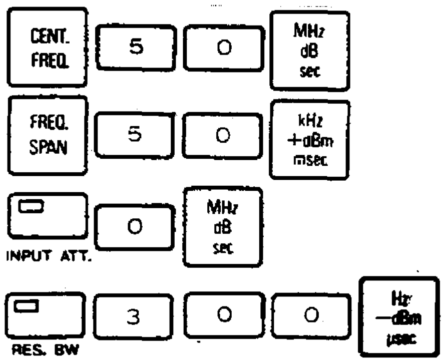
Fig. 12-15 Noise sideband

12-3-19. Adjacent Spurious

Specification: 70 dB (below carrier level)

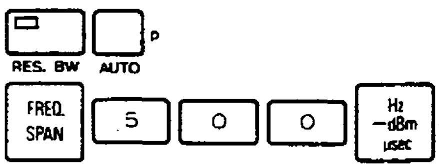
(1) While the instrument is in the initial default state, set it up as follows:

Connect the CAL. OUT. connector the INPUT-1 connector, then key in as follows:

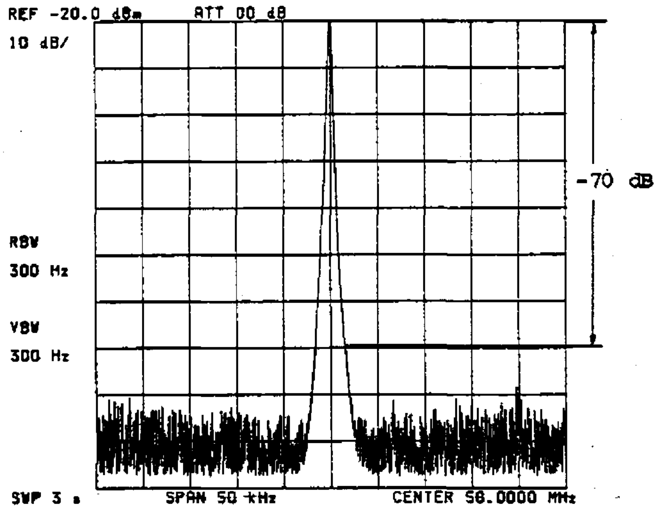


(2) Check to make sure that no spurious response exists within -70 dB from the carrier peak level.

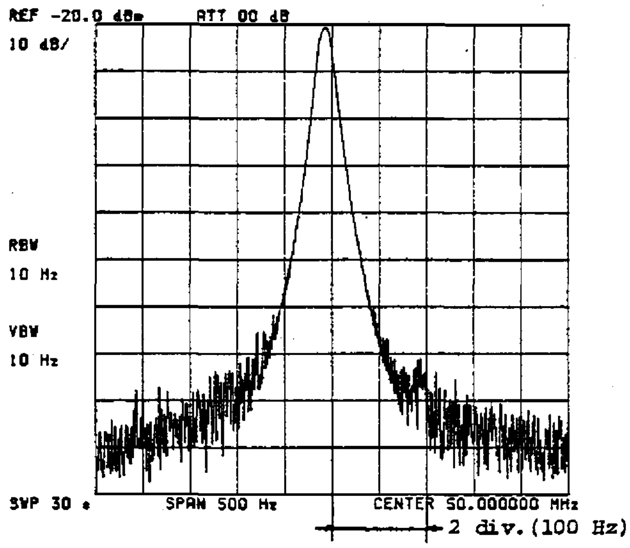
(3) Now set up as follows:



(4) Check to make sure that the spurious response at 100 Hz or more apart from the carrier peak is less than -70 dB in its level.



(1)



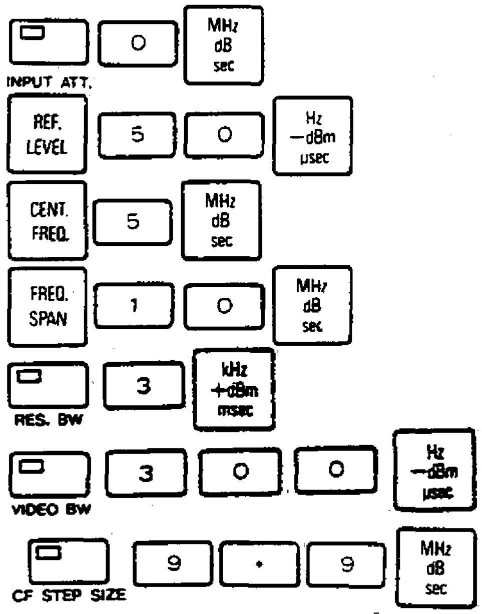
(2)

Fig. 12-16 Adjacent spurious

12-3-20. Residual Response

Specification: Not more than -100 dBm (with input ATT set at 0 dB, and no input signal applied)

(1) While the instrument is in the initial default state, set it up as follows:



(2) Check again to make sure that no input signal or connector is coupled to the input of the instrument.

(3) Press CENT. FREQ. . There after each time ⇧ is pressed, the center frequency will increase 9.9 MHz steps. Check to make sure that no residual response with its level exceeding -100 dBm exists between 0 and 1800 MHz.

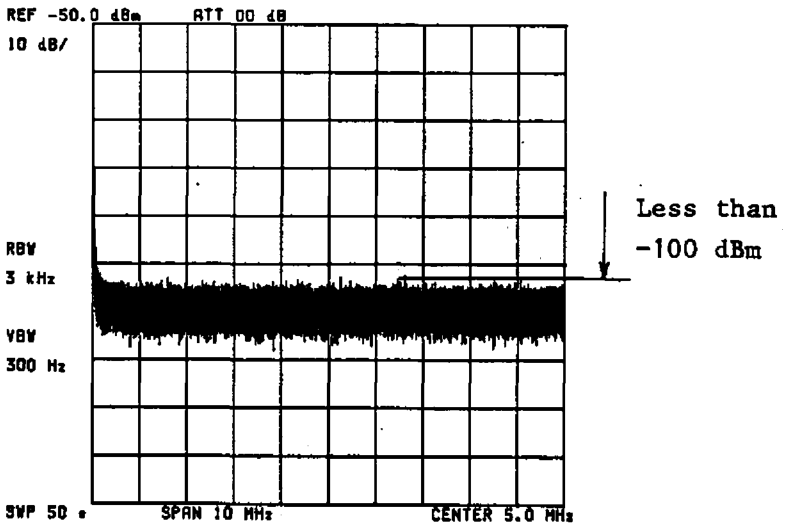


Fig. 12-17 Residual response

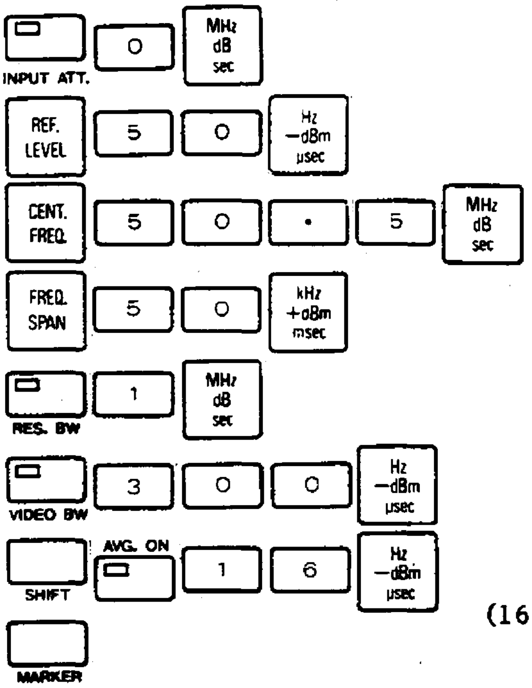
12-3-21. Noise Level

Specification: -80 dBm at resolution BW of 1 MHz and video BW of 1 Hz.
-85 dBm at resolution BW of 300 kHz and video BW of 1 Hz.
-100 dBm at resolution BW of 10 MHz and video BW of 1 Hz.
-105 dBm at resolution BW of 3 kHz and video BW of 1 Hz.
-130 dBm at resolution BW of 10 Hz and video BW of 1 Hz.
(Center frequency > 1 MHz)

(1) While the instrument is in the initial default state, set it up as follows:
Connect the CAL. OUT. connector to the INPUT-1 connector, then enter the following:

(Executes the error correction routine.)

Disconnect the CAL. OUT. signal cable and cable adapter from the INPUT-1 connector, then enter as follows:



(16 repetitions of averaging)

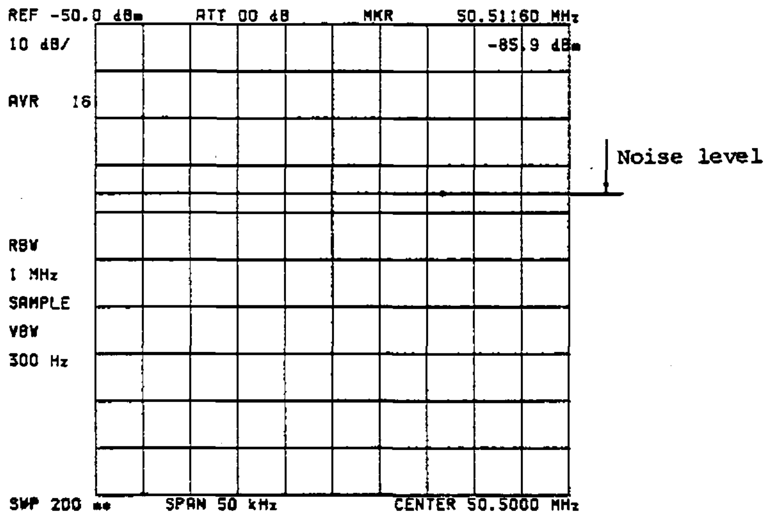
(2) Read the marker level and check to make sure that the level meets the noise level specification (below −80 dBm) at resolution bandwidth of 1 MHz. After completing checking, press 

to clear the Averaging mode.

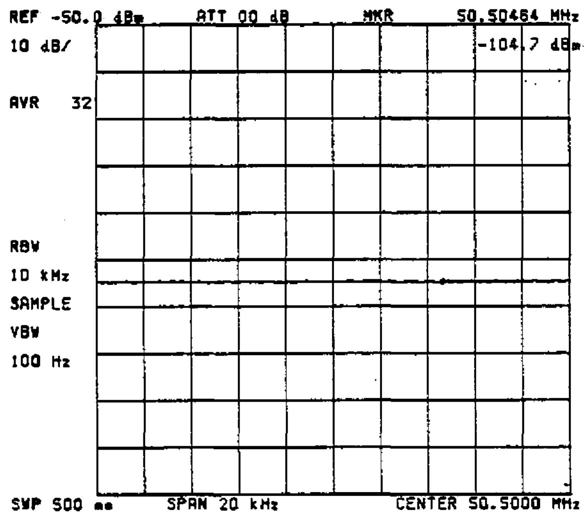
(3) Similarly, check the noise levels at each resolution bandwidth. The optimum setup values are listed in Table 12-5. If slight peaks and dips remain in the signal response after averaging, slightly move the marker and read an averaged level.

Table 12-5

RES. BW	1 MHz	300 kHz	10 kHz	3kHz	10 Hz
FREQ. SPAN	50 kHz	50 kHz	20 kHz	20 kHz	100 Hz
VIDEP BW	300 Hz	300 Hz	100 Hz	30 Hz	10 Hz
No. of AVG	16	16	32	32	32



(1)



(2)

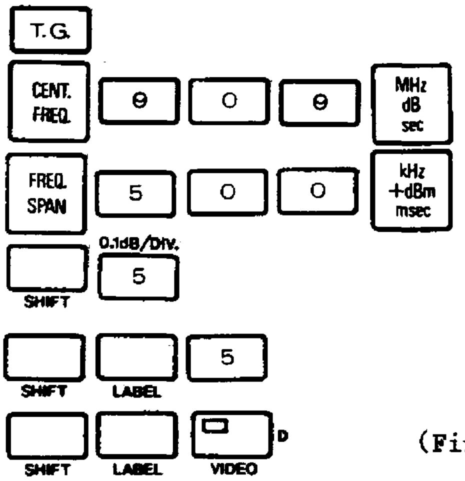
Fig. 12-18 Noise Level

12-3-22. Fine Tune Level Deviation

Specification: Less than 0.5 dB p-p

(1) While the instrument is in the initial default state, set it up as follows:

Connect the TRACKING GENERATOR OUTPUT connector to the INPUT-1 connector with a BNC-BNC cable, then enter as follows:



(Fine Tune flatness check mode)

(2) Next, change the reference level until the TG signal response is observed on the display.

(3) Press A VIEW to store the signal response.

(4) Press PEAK SEARCH Δ SHIFT NEG. PEAK S. to read the difference between the maximum and minimum levels of the TG signal response by means of he delta marker. Check to make sure that the difference is less than 0.5 dB.

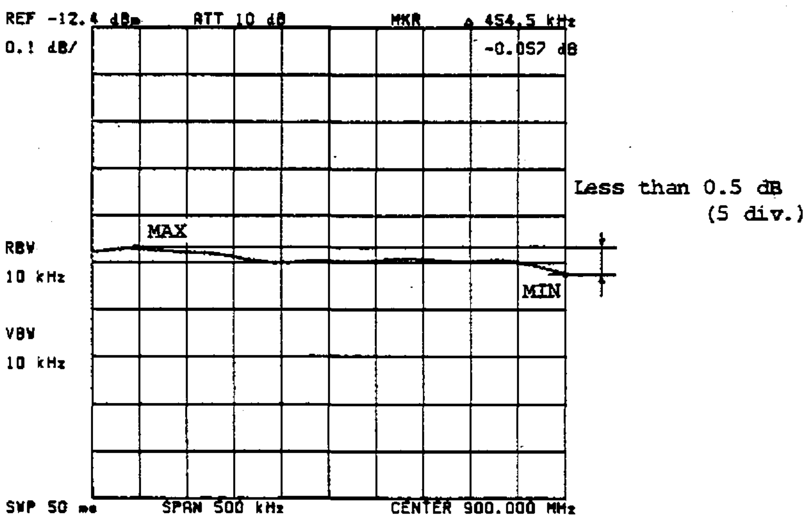
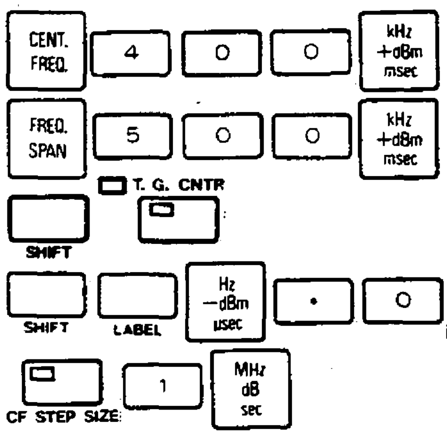


Fig. 12-19 Fine Tune level deviation

12-3-23. Counter Operation (Operating Frequency)

Specification: Operating frequency 400 kHz to 1500 MHz

(1) While the instrument is in the initial default state, set it up as follows:

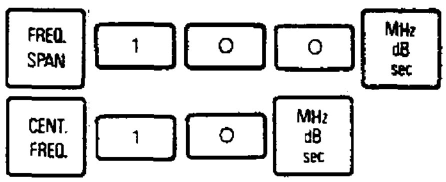


(Directly counts TG frequency.)

(2) Check to make sure that the counter is normally counting, with its readout digits indicating constant numbers (except for the 100 Hz digit which may be flickering).

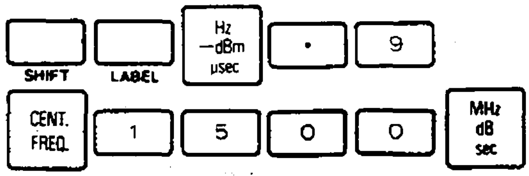
(3) Press  , then use  to set the center frequency to 10.4 MHz (at 1 MHz stepping). Check to make sure that the then counter reading is identical to the center frequency readout (with an allowance of 1% of the frequency span).

(4) Now enter the following:



(5) By turning the DATA knob slowly, sweep the center frequency from 10 MHz through 1500 MHz, and check to make sure that the counter reading is identical to the center frequency readout (with an allowance of 1% of the frequency span) over the entire sweep span.

(6) Now enter as follows:



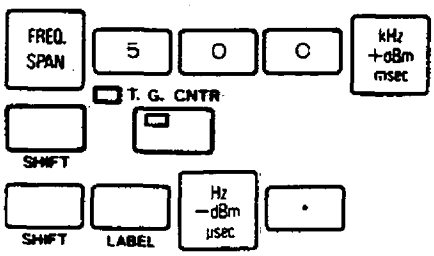
(Counter Auto mode)

(7) By slowly turning the DATA knob, sweep the center frequency from 1500 MHz through 1800 MHz, and check to make sure that the counter normally counts over the entire sweep span.

12-3-24. Counter Operation (Local Frequency Counting)

Specification: Should normally count each local frequency.

(1) While the instrument is in the initial default state, set it up as follows:



(2) Sequentially press numeric dat keys ($\boxed{0}$ through $\boxed{9}$) to select the tracking generator output and local frequency count modes. Check to make sure that the following specifications are satisfied in each of these modes:

$\boxed{0}$: Count Point TG

Directly counts the TG output frequency identified by the marker. The Counter reading is identical to the center frequency readout, with an allowance of 1%,

$\boxed{1}$: Count Point 3RD LO 23M VCO

Shows the output frequency of the 3rd local VCO (23 MHz). The counter operation is assumed to be normal if all the digits other than the LSD (which may be flickering) give a constant frequency readout over 22 to 24 MHz.

[2] : COUNT POINT 3RD LO 2M VCO

Shows the output frequency of the 3rd local VCO (2 MHz). The counter operation is assumed to be normal if all the digits other than LSD give a constant readout over 0.9 to 1.1 MHz.

[3] : COUNT POINT TG 200 M IF

Shows 0 MHz as this mode is currently not used.

[4] : COUNT POINT 1ST LO IF

Shows the IF frequency for the 1st local oscillator. It normally indicates a frequency below 50 MHz. When the frequency span setting is 500 kHz or below, the counter will show a frequency with no fractional part.

[5] : COUNT POINT 2ND LO 204M

Shows the IF frequency for the 2nd local oscillator. The counter operation is assumed to be normal if all the digits other than the LSD give a constant frequency readout at around 204 MHz.

[6] : COUNT POINT 3RD LO 153 M

Shows the 3rd local oscillator output of 153 MHz. The counter operation is assumed to be normal if all the digits other than the LSD give a constant frequency readout at around 153.3 MHz.

[7] : COUNT POINT 4TH LO 33 M

Shows the 4th local oscillator output of 33 MHz. The counter operation is assumed to be normal if all the digits other than the LSD give a constant frequency readout at around 33.3 MHz.

[8] : COUNT POINT 1ST LO

Shows the 1st local oscillator output frequency. It is not a direct count but a value determined from the 1st IF frequency. The counter operation is assumed to be normal if all digits above the 1 MHz order give a constant readout with no flicker.

9 : COUNT POINT AUTO

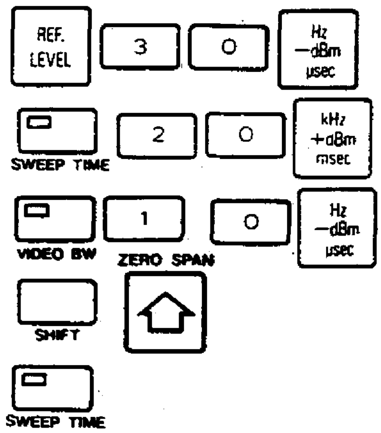
Normally counts the TG output frequency identified by the marker. In the frequency ranges which are beyond the counting capability of the counter (0-400 kHz and 1500-1800 MHz), the marker frequency is determined from each local frequency. The counter reading is the same as the center frequency readout, with an allowance of 1%.

12-3-25. Analog Sweep

Specification: Error on the vertical axis: ±0.2 div. or less when sweep time is 19 ms.

Error on the horizontal axis: 0-0.5 div. at zero frequency span.

(1) While the instrument is in the initial default state, set it up as follows:



(An UNCAL message will be shown; ignore it.)

(2) Next, alternately press ⇩ and ⇧ to switch between analog sweep (10 ms) and digital sweep (20 ms).

(3) Check to make sure that the positional departure between the analog and digital traces is within the specification along both vertical and horizontal axes.

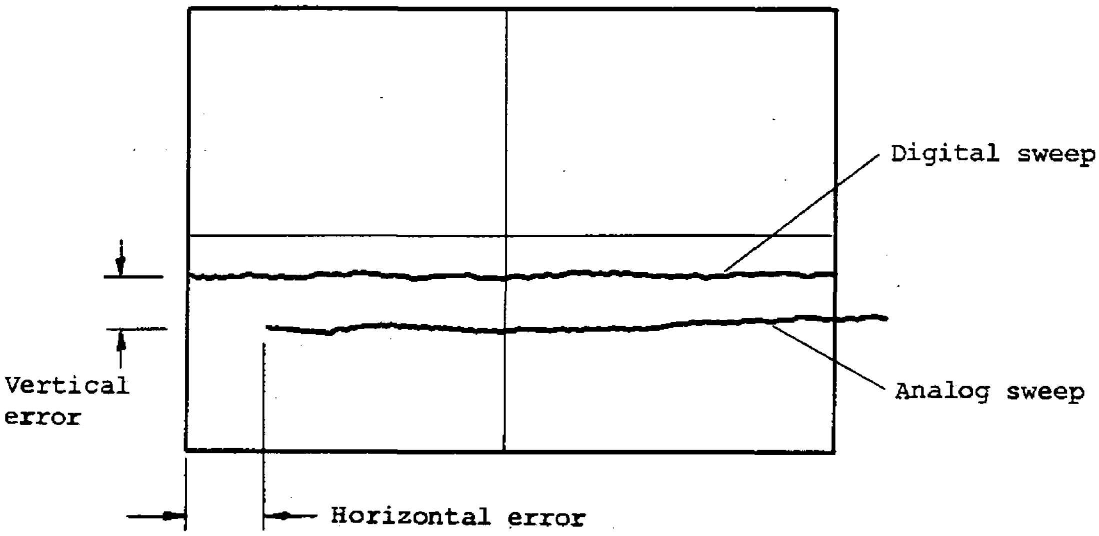
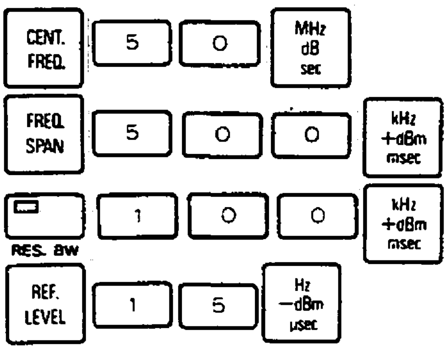


Fig. 12-20 Analog Digital Sweep Switching Error

12-3-26. Reference Level Variable Range

Specification: Should be variable over 4 dB p-p or more.

(1) While the instrument is in the initial default state, set it up as follows:
Connect the CAL. OUT. connector to the INPUT-1 connector, and enter as follows:



(2) Next, turn the screwdriver control marked CAL on the front panel fully counterclockwise. Press PEAK SEARCH, then read the signal level at that point.

(3) Then turn the CAL control fully clockwise. Press PEAK SEARCH, then read the signal level at that point. Check to make sure that the marker level readout has changed by more than 4 dB.

12-3-27. GP-IB Check

Check for the normal GP-IB functions by referring to SECTION 8 (GP-IB ATTACHMENT AND PROGRAMMING SUPPORT.)

12-3-28. Key Operation Check

Check for normal key operations (except for screwdriver controls) by referring to paragraph 3-3-1 Front Panel Description.

12-4. PREFORMANCE CHECK REQUIRING MEASURING INSTRUMENTS

12-4-1. Sweep Time

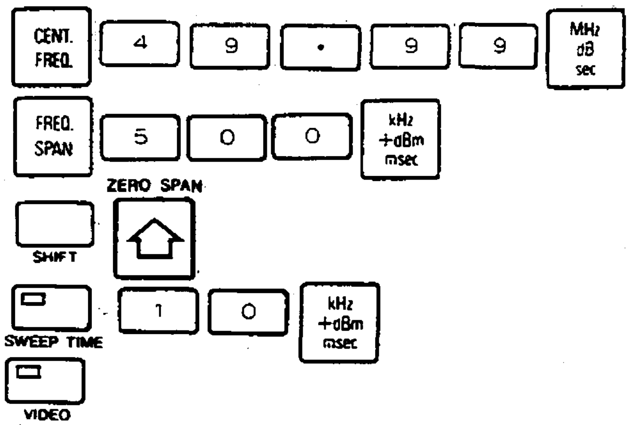
Specification: ±5% over 20 ms to 1000 s
±5% over 100 μs to 1000 s (at zero frequency span)

Required instruments: Signal generator (SG) capable of frequency modulation
Stop watch

(1) While the instrument is in the initial default state, apply a 50 MHz signal modulated with a 1 kHz signal from a signal generator (SG) to the input of the instrument. Set up the SG output as follows:

Carrier frequency: 50.00 MHz
Output level: -10 dBm
Modulation frequency: 1 kHz (AM)
Modulation depth: 10%

(2) Then set up the instrument as follows:



Adjust the TRIGGER LEVEL control until the signal trace stops on the display.

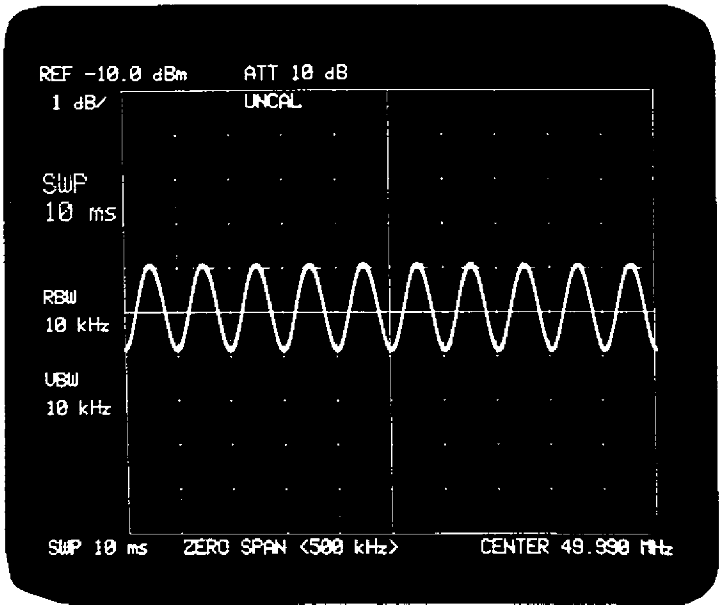


Fig. 12-21 Sweep time check

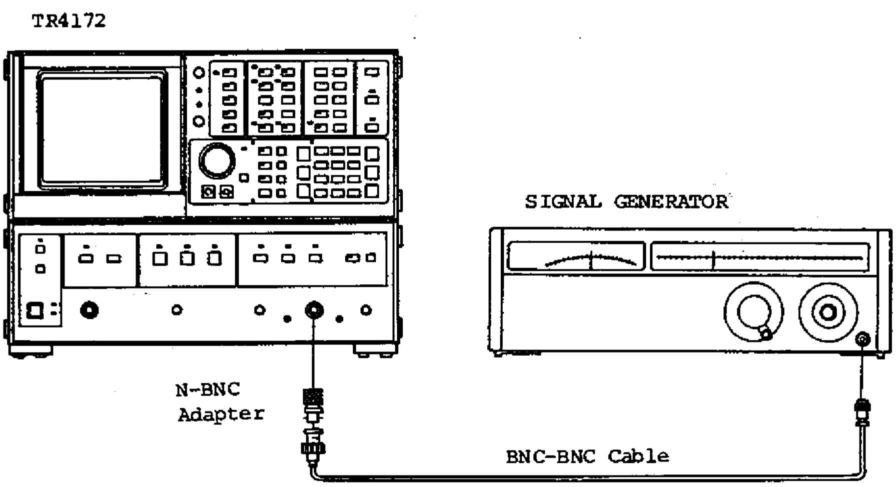


Fig. 12-22 Sweep time test setup

(3) Each division of the horizontal scale is assigned 1 ms as the sweep time is 10 ms. Since the 1 kHz signal has a period of 1 ms, the peaks or dips of the signal envelope should match each graticule on the screen. Visually check this point. The allowable deviation from the graticule is 0.5 div.

When using a stop watch:

(1) While the instrument is in the initial default state, set it up as follows:

[SWEEP TIME] [1] [0] [0] [MHz dB sec]

(2) Use the stop watch to measure the time required for a bright dot to sweep all the way from the leftmost to the rightmost graticule on the screen. Set the sweep time to 100 s, and check to make sure that the actual sweep time is 100 ± 5 s.

12-4-2. Scan Trigger

Specification: Internal, Line, External, Video, Single

Video: Trigger point should be able to be variable over 1 division of the scale.

Single: Only one sweep should be triggered each time the key is operated.

Required instrument: Signal generator capable of frequency modulation.

(1) While the instrument is in the initial default state, set it up as follows:

[SWEEP TIME] [2] [0] [kHz +dBm msec]

(2) Press [LINE] to select the Line Trigger mode. The flashing frequency of the SWEEP IND. lamp will be lowered to indicate that the Line Trigger mode is selected.

(3) Next, press [EXT.] to select the External Trigger mode. Check to make sure that sweep is triggered each time the rear EXT. TRIG. connector is grounded (coupled with an earth potential).

(4) Press MASTER RESET to return the instrument into the initial default state. Apply a 50 MHz signal modulated with a 1 kHz signal from a signal generator (SG) to the input of the instrument. Set up the SG output as follows:

Frequency: 50.00 MHz

Output level: -10 dBm

Modulation frequency: 1 kHz

Modulation depth: 10%

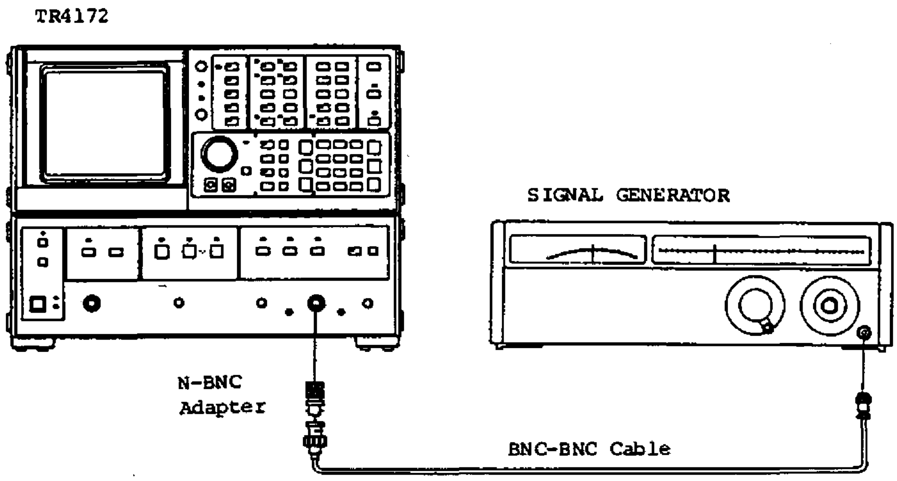
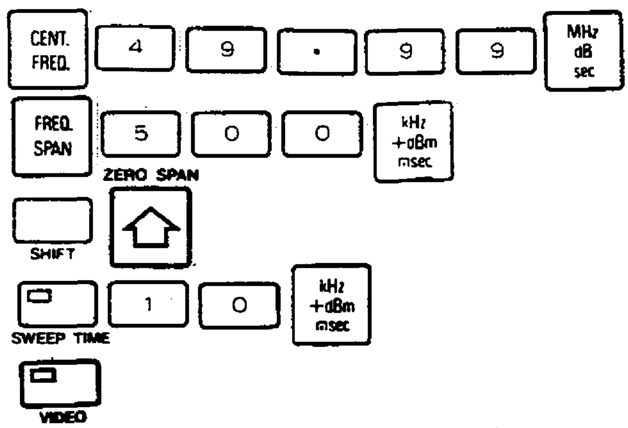


Fig. 12-23 Scan trigger test setup

(5) While the instrument is in the initial default state, set it up as follows:



(6) While watching the signal trace on the display, turn the TRIGGER LEVEL control to make sure that the trigger point is variable over at least one division of the display scale.

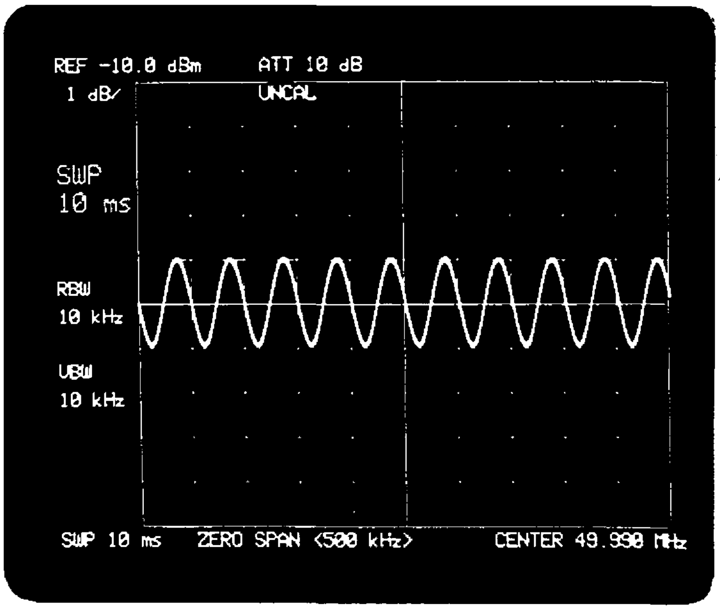


Fig. 12-24 Trigger level check

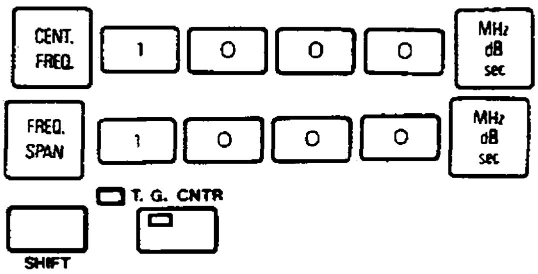
(7) Press [MASTER RESET] to return the instrument into the initial default state. Check to make sure that only one sweep is triggered each time [SINGLE] key is pressed.

12-4-3. Center Frequency Accuracy

Specification: $\pm$(span x 1% $\pm$20 Hz)

Required instrument: Synthesized signal generator

(1) While the instrument is in the initial default state, set it up as follows:



(2) Since the marker is located in the center of the scale, the marker frequency readout directly indicates the center frequency. Confirm that the readout is within 1000 MHz ±10 MHz The center frequency accuracy with broad frequency span setting can be known with the just described procedure. However, this technique (in which the internal counter is used for frequency measurement) is not adequate for measurement a frequency span setting of less than 10 kHz, where measurement is affected by tracking error of the tracking generator.

(3) If the synthesized signal generator has a reference time-base input, apply the REF. signal output from the INT. STD. OUTPUT connector (J4) of the instrument to this input, then press [SHIFT] [LABEL] [7] (INT. STD OUTPUT ON), and set up the SG output as follows. If the SG has no reference input, it may be used so far as its output frequency accuracy is 5×10^{-9} or less.

Output frequency: 1000 MHz

Output level: -20 dBm

(4) Connect the SG output to the input of the instrument.

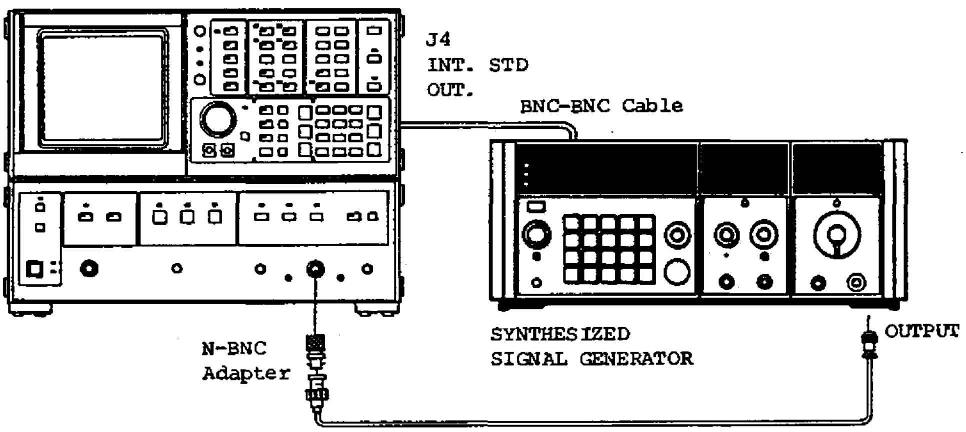


Fig. 12-25 Center frequency accuracy test setup

(5) Next, press [FREQ SPAN] [1] [0] [0] [Hz -dBm μsec] to set the frequency span to 100 Hz.

(6) Confirm that the deviation of the input signal peak from the center graticule is less than ±21 Hz.

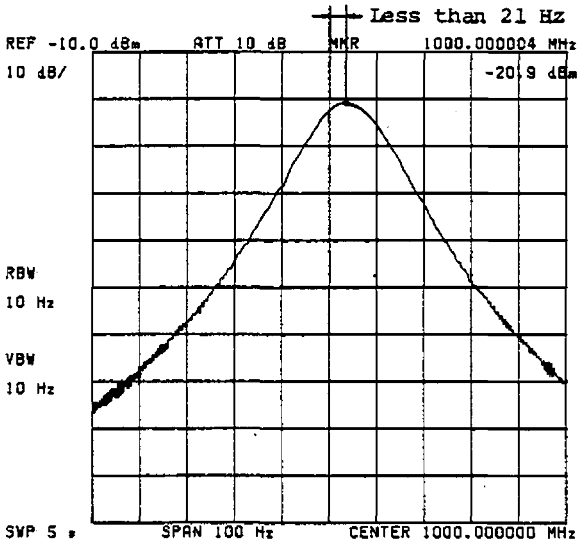


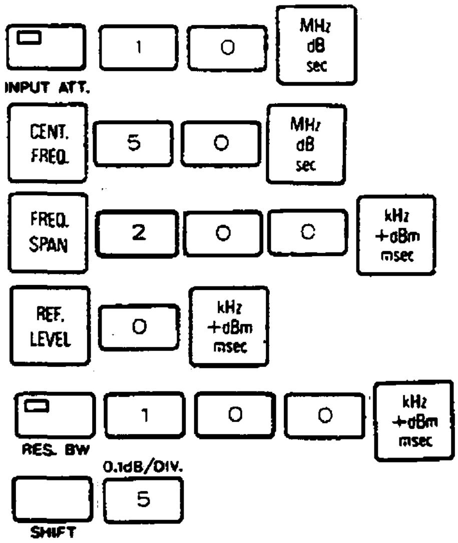
Fig. 12-26 Center frequency deviation

12-4-4. Vertical Scale Linearity (logarithmic scale)

Specification: ±0.02 dB/div. at 0.1 dB/div over 0 to 0.8 dB
±0.2 dB/div. at 1 dB/div. over 0 to 95 dB
±1 dB/div. at 10 dB/div. over 0 to 95 dB (20°C to 30°C)
±1.5 dB/div. at 10 dB/div. over 0 to 95 dB (0°C to 40°C)

Required instrument: External attenuators covering:
0 to 110 dB at 10 dB steps
0 to 11 dB at 1 dB step
0 to 1.1 dB at 0.1 dB step

(1) While the instrument is in the initial default state, set it up as follows:



(2) Apply a synthesized SG output of 50 MHz, 0 dBm to the input of the analyzer via an external attenuator. Set the attenuator to 0 dB attenuation. While slightly adjusting the SG output, position the signal response peak on the display to the top graticule.

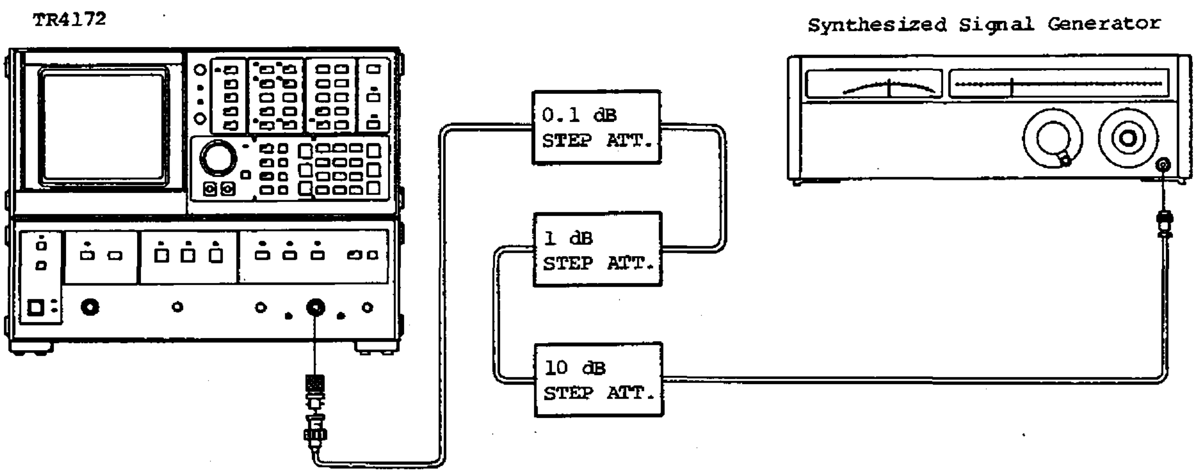


Fig. 12-27 Vertical scale linearity (log.) test setup

(3) Increase the attenuation of the external attenuator at 0.1 dB steps, confirm that each 0.1 dB increase in attenuation causes the signal peak on the display to be lowered 0.1 dB (1 div.) with an error of 0.02 dB (0.2 div.) each time.

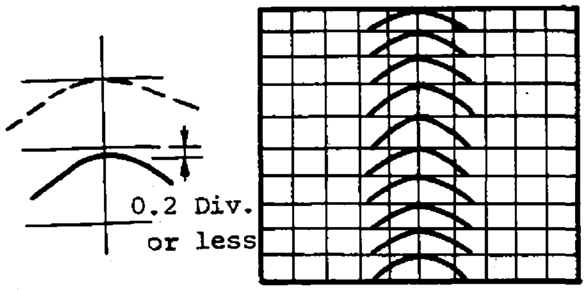


Fig. 12-28 Vertical scale linearity check

For accurate level identification, it is recommend to use [PEAK SEARCH] key each time the attenuation is increaseds.

(4) Then press [SHIFT] [4 (1dB/DIV.)] to select a vertical scale factor of 1 dB/div. Set the external attenuator to 0 dB attenuation, then position the signal response peak to the top graticule on the display.

(5) While increasing the attenuation of the external attenuator by 1 dB steps, confirm that each 1 dB (1 div.) increase in attenuation causes the signal peak to be lowered one division (1 dB) with an error of ±0.2 dB (±0.2 div.) each time.

(6) Update the instrument setup as follows in temperature 20°C to 30°C:

[INPUT ATT.] [1] [0] [MHz dB sec]

[CENT. FREQ.] [5] [0] [•] [5] [MHz dB sec]

[FREQ. SPAN] [1] [kHz +dBm msec]

[REF. LEVEL] [0] [kHz +dBm msec]

[RES. BW] [3] [0] [Hz −dBm μsec]

[SHIFT] [7 (10dB/DIV.)]

(7) Set up SG output to 50.5 MHz, 0 dBm, and couple it to the input of the analyzer via the external attenuator. Set the attenuator to 0 dB attenuation. While slightly adjusting the SG output, position the signal response peak to the top graticule on the screen.

(8) While increasing the attenuation of the external attenuator from 0 to 90 dB at 10 dB steps, confirm that each 10 dB increase in attenuation causes the signal peak to be lowered by 10 dB (1 div.) with an error of ± 1 dB (0.1 div.) or less each time.

(9) Now set the external attenuator back to 0 dB attenuation. Slightly reduce the SG output level until the marker readout for the signal peak is −5 dBm.

(10) While increasing the attenuation of the external attenuator from 0 to 90 dB at 10 dB steps, confirm that each 10 dB increase in attenuation causes the signal peak to be lowered by 10 dB (1 div.) with an error of ± 1 dB (0.1 div.) each time.

(11) In a temperature range between 0°C and 40°C, perform test steps (6) and below, and confirm that the signal peak error is within ± 1.5 dB.

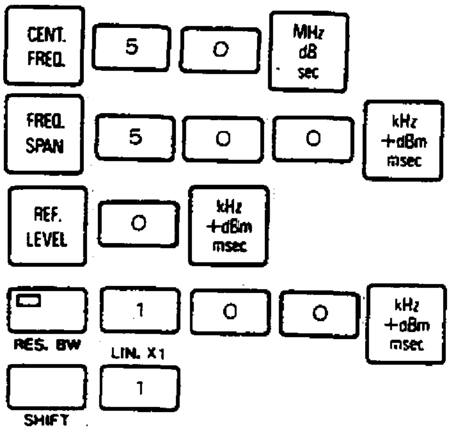
12-4-5. Vertical Scale Linearity (linear scale)

Specification: Within ±3% of the reference level

Required instruments: Signal generator

External attenuator covering 0 dB to 11 dB at 1 dB steps

(1) While the instrument is in the initial default state, set it up as follows:



(2) Apply as SG output of 50 MHz, 0 dBm to the input of the analyzer via an external attenuator. Set the external attenuator to 0 dB attenuation. While adjusting the SG output level, position the input signal response peak to the top graticule.

(3) Press PEAK SEARCH and record the marker readout for the signal peak as "a" mV.

(4) Next, set the attenuator to 6 dB attenuation (1/2 on the linear scale). Press PEAK SEARCH and record the marker readout for the signal peak as "b" mV.

(5) Determine the ratio of a half of "a" (mV) to "b" (mV) in percentage, and confirm that the ratio is within the specification (2b/a x 100 = between 97% to 103%).

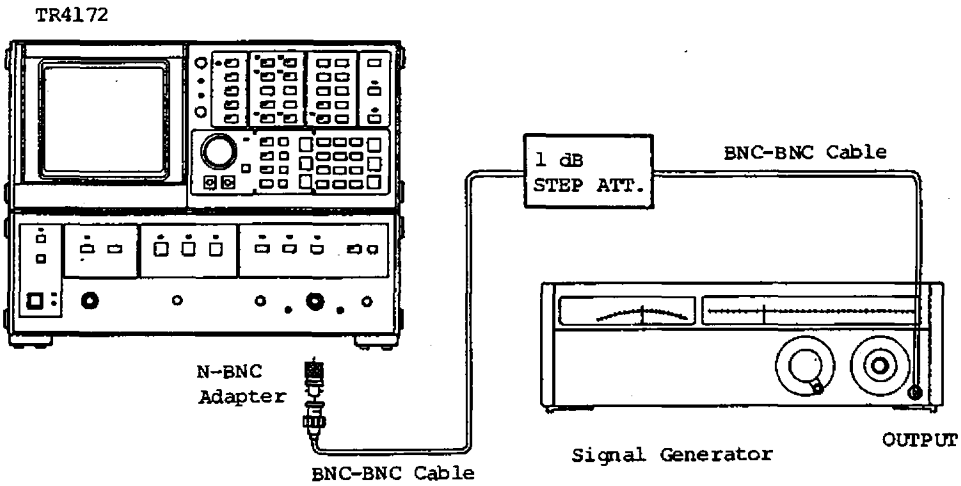


Fig. 12-29 Vertical scale linearity (lin.) test setup

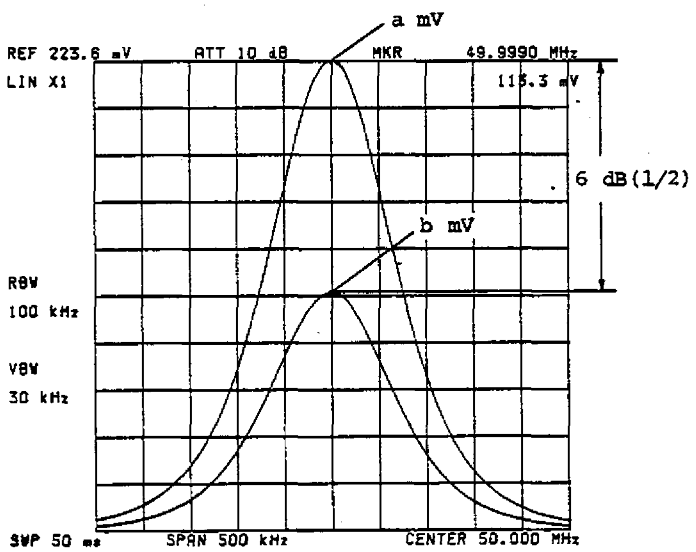


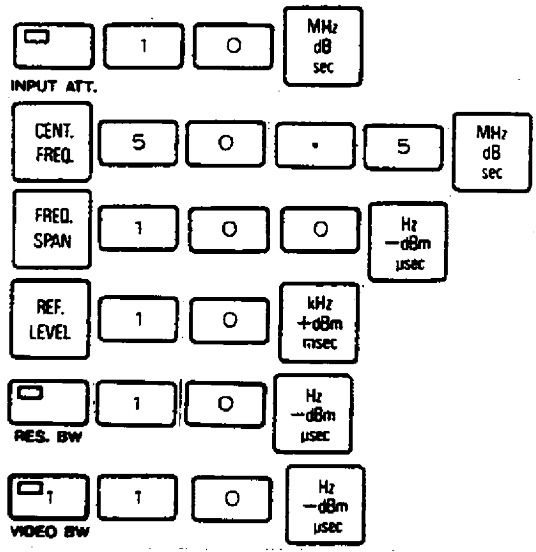
Fig. 12-30 Linear scale linearity check

12-4-6. Reference Level Accuracy

Specification: Within ±1.0 dB after calibration and error correction

Required instruments: Synthesized signal generator
External attenuator covering 0 to 110 dB at 10 dB steps

(1) While the instrument is in the initial default state, set it up as follows:



(2) Apply an SG output of 50.5 MHz, 0 dBm to the input of the analyzer via an external attenuator.

(3) Set the external attenuator to 0 dB attenuation. Press PEAK SEARCH to read the peak level of the signal response. Adjust the SG output level until the peak readout is 0.0 dBm.

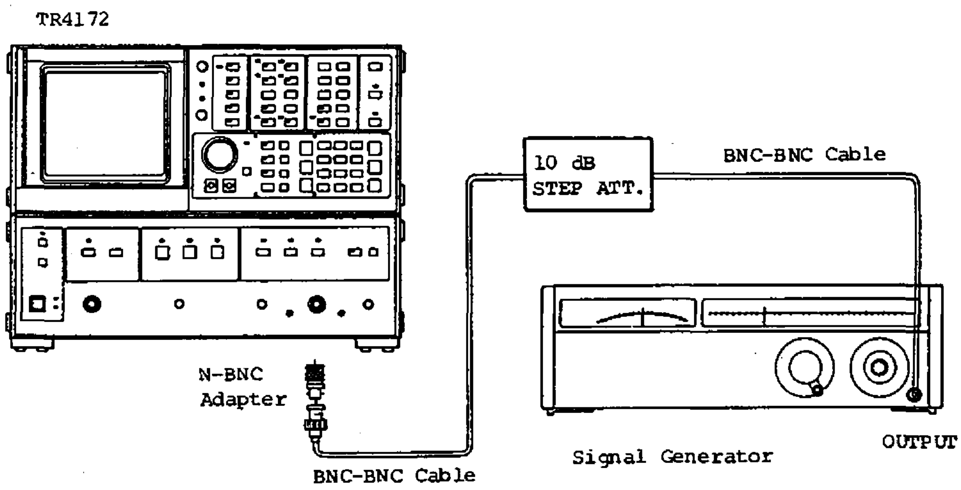


Fig. 12-31 Reference level accuracy test setup

(4) While increasing the attenuation of the external attenuator by 10 dB steps, lower the reference level by 10 dBm steps with [REF. LEVEL] accordingly, and read each canceled level with [PEAK SEARCH]. Confirm that marker readout error between each level is within ±1.0 dB. The following table shows the relationship between reference levels, external attenuator settings, and input levels.

Table 12-6 Ref. levels vs. external attenuator

REF level	Ext. ATT.	Input level	
+10 dBm	0 dB	0 dBm	IF 10 dB STEP AMP.
0 dBm	10 dB	-10 dBm	
-10 dBm	20 dBm	-20 dBm	
-20 dBm	30 dBm	-30 dBm	
-30 dBm	40 dBm	-40 dBm	
-40 dBm	50 dB	-50 dBm	
-50 dBm	60 dB	-60 dBm	
-60 dBm	70 dB	-70 dBm	
-70 dBm	80 dB	-80 dBm	
-80 dBm	90 dB	-90 dBm	
-90 dBm	100 dB	-100 dBm	

12-4-7. Frequency Response

Specification: 2 dB p-p over 50 Hz to 1 GHz

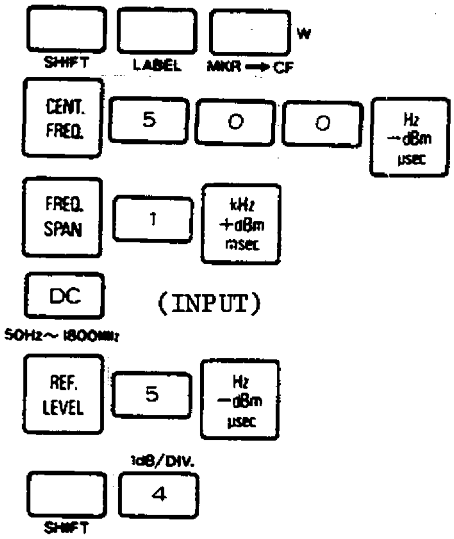
3 dB p-p over 50 Hz to 1.8 GHz

Within ±0.7 dB over 400 kHz to 1.8 GHz after error correction

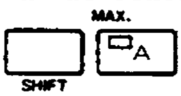
Required instrument: Signal generator

CAUTION: The frequency response of the signal generator itself causes a measurement error. Before using the generator, calibrate it by measuring the levels of major frequency points with a power meter.

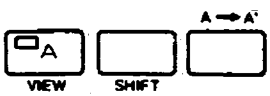
(1) While the instrument is in the initial default state, set it up as follows:



(2) Apply an SG output of 50 Hz, -10 dBm to the input of the analyzer. Adjust the REF. level until the signal response is positioned in the center of the vertical scale.

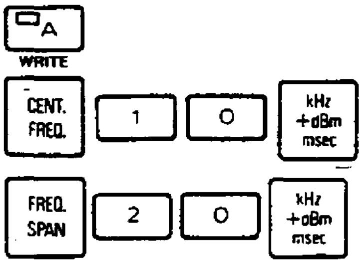
(3) Then press 

to enter the A Max Hold state. Slowly sweep the SG output frequency from 50 Hz through 1 kHz to store the frequency response in memory.

(4) Press 

to store the frequency response into A' memory.

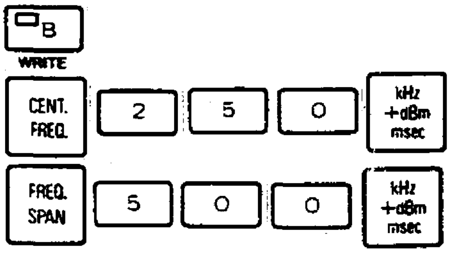
(5) Update the setup for the instrument as follows:



(6) Press SHIFT MAX. A to enter the A Max Hold state. Slowly sweep the SG output frequency from 1 kHz through 20 kHz to store the frequency response in this range.

(7) Press SHIFT BLANK A VIEW to store the frequency response over 1 kHz to 20 kHz into memory A. The signal trace is blanked.

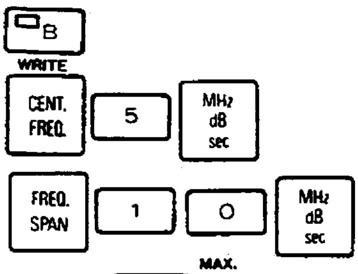
(8) Update the setup as follows:



(9) Press SHIFT MAX. B to select the B Max Hold state. Slowly sweep the SG output frequency from 20 kHz through 500 kHz to store the frequency response.

(10) The press B→B' to store the frequency response over 20 to 500 kHz into memory B'.

(11) Now update the setup as follows:

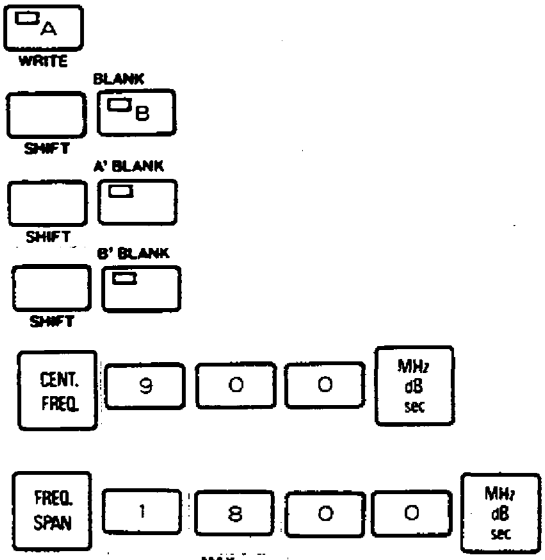


(12) Press SHIFT MAX. B to select the B Max Hold state. Slowly sweep the SG output frequency from 500 kHz through 10 MHz to store the frequency response between these frequencies.

(13) Press B VIEW to store the frequency response over 500 kHz to 10 MHz into memory B.

(14) Operation of A VIEW, A' VIEW, and B' VIEW will show the frequency response over 50 Hz through 10 MHz on the display. Record the maximum and minimum levels in the frequency response.

(15) Update the setup as follows:



(16) Press SHIFT MAX. A to select the A Max Hold state. Slowly sweep the SG output frequency from 10 MHz through 1800 MHz to store the frequency response.

(17) Superimpose the previous recorded frequency response between 50 Hz and 10 MHz over the last one (between 10 and 1800 MHz), to make sure that the peak and dip of the frequency response is less than 2 dB p-p over 50 Hz to 1000 MHz. Also confirm that the frequency response error is less than 3 dB p-p over 50 Hz to 1800 MHz.

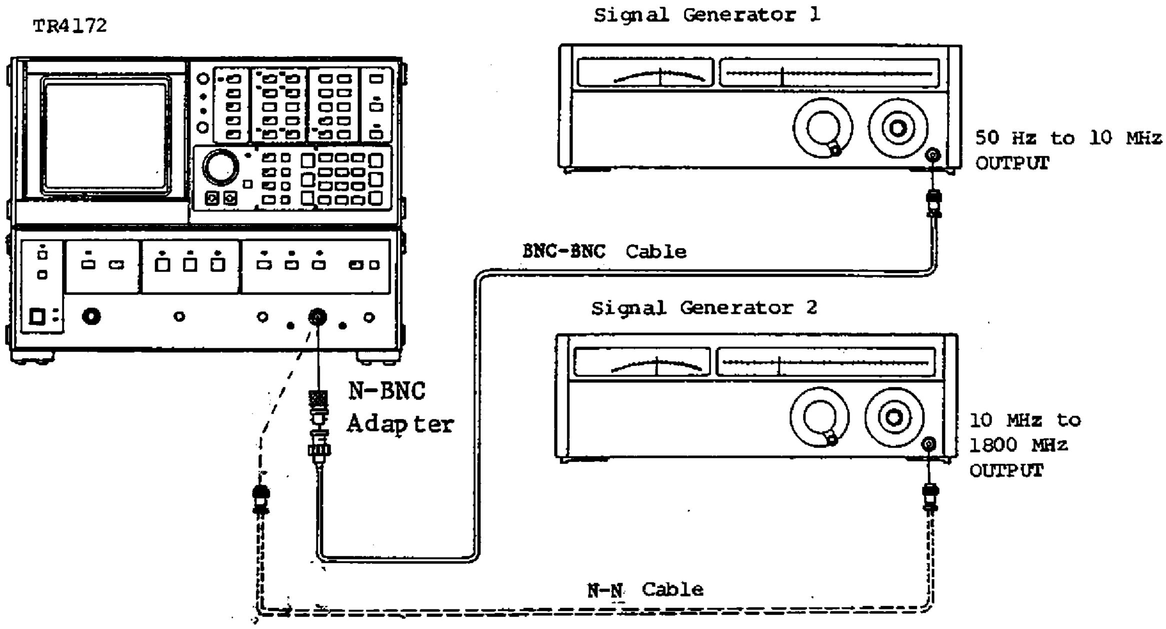


Fig. 12-32 Frequency response test setup

12-4-8. Spurious Response (Secondary Harmonic Distortion)

Specification: -60 dB or less when the center frequency ≧ 20 MHz
with an input level of -10 dBm.
-45 dB or less when the center frequency < 20 MHz
with an input level of -10 dBm.

Required instrument: Low distortion oscillator
(with the 2nd harmonic level of less than
-70 dB)

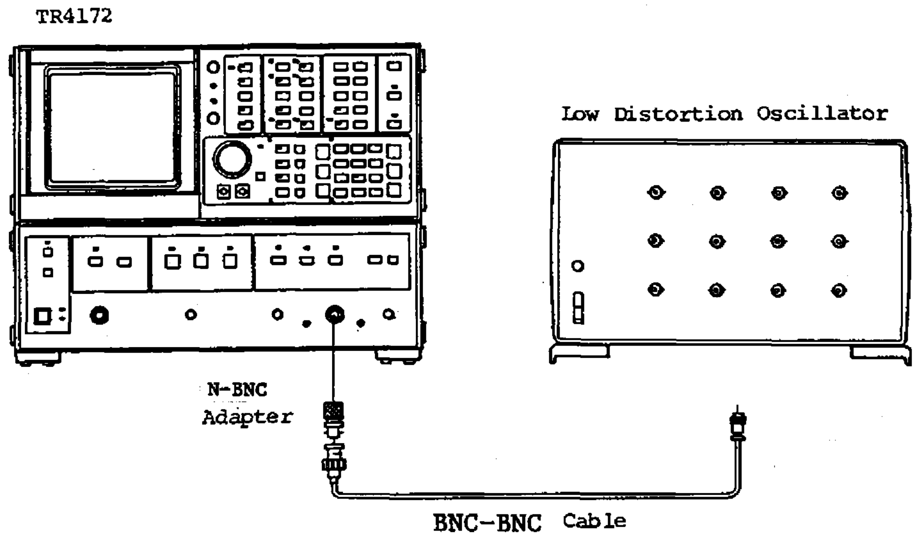


Fig. 12-33 2nd harmonic distortion check setup

(1) While the instrument is in the initial default state, set it up as follows:

[INPUT ATT.] [.0] [MHz dB sec]

[CENT. FREQ.] (Frequency of the Low distortion oscillator)

[FREQ. SPAN] [2] [0] [MHz dB sec]

[VIDEO BW] [3] [kHz +dBm msec]

[REF. LEVEL] [1] [0] [Hz −dBm µsec]

(2) Apply a -10 dBm signal from the low-distortion oscillator to the input of the analyzer.

(3) Press [PEAK SEARCH] [MKR→CF] [MKR/Δ →STEP SIZE] [MKR→REF.] to read the marker readout for the input signal level.

(4) Next, press [CENT. FREQ.] [⇧] to double the center frequency. Read the 2nd harmonic distortion level at that frequency to confirm that it is less than -60 dB below the fundamental component level (less than -45 dB when the input frequency is less than 20 MHz).

(5) Check the distortion at other frequencies in the same way.

Note: An ordinary signal generator with a low-pass filter provided at its output to eliminate the 2nd harmonic distortion may be used instead of the low-distortion oscillator (with a 2nd harmonic distortion level of less than -70 dB). If the former type of signal generator is used, set the level at the input terminal to -10 dBm after the signal passes through the low-pass filter and input cable.

12-4-9. Spurious Response (Two signal distortion)

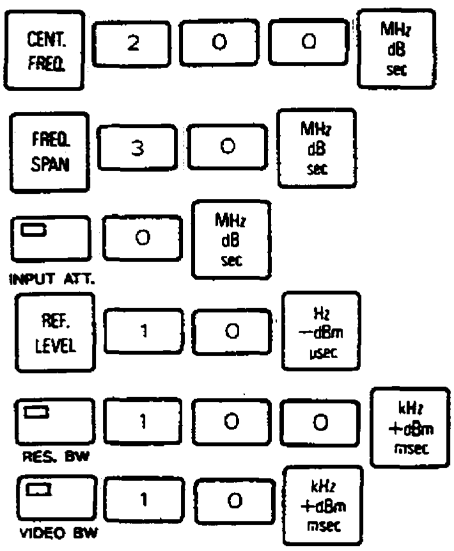
Specification: Less than -50 dB for two signals of -10 dBm with separation greater than 5 MHz

Less than -45 dB for two signals of -10 dBm with separation less than 5 MHz

Required instruments: Two signal generators

Isolated power splitter

(1) While the instrument is in the initial default state, set it up as follows:



(2) Next, set the output of one of the signal generators to 197 MHz, -4 dBm (when a 6 dB power splitter is used), and set the output of the other signal generator to 203 MHz, -4 dBm (with a 6 dB power splitter). Apply these SG outputs to the power splitter, and couple the output of the power splitter to the input of the analyzer.

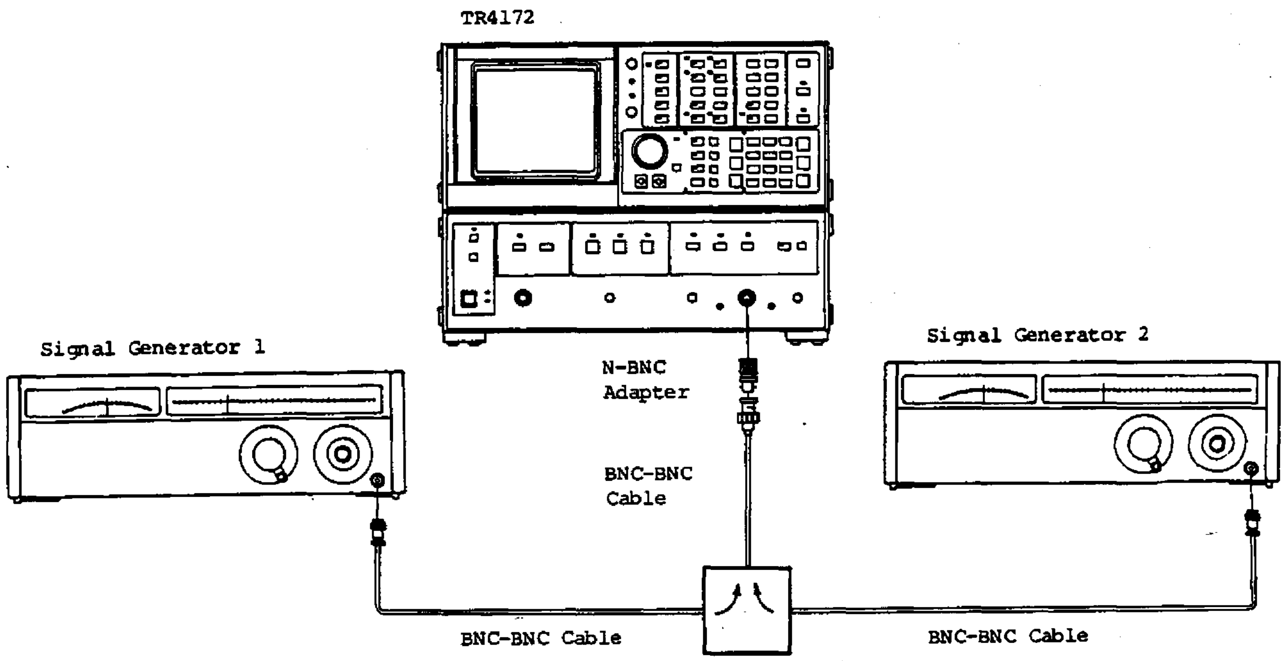


Fig. 12-34 Spurious response (Two signal distortion) test setup

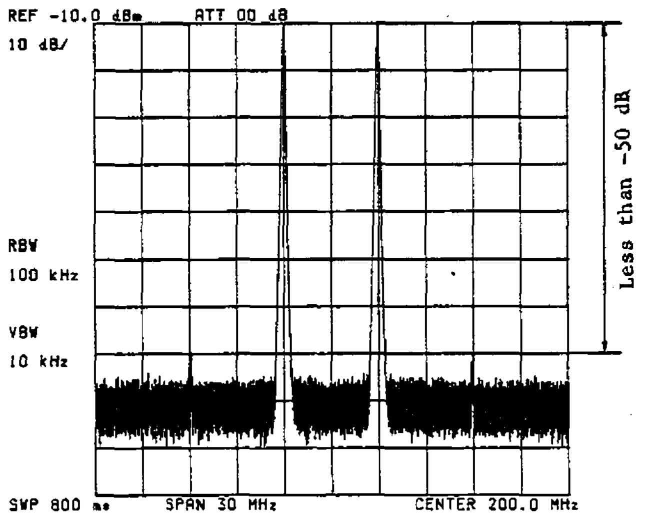


Fig. 12-35 Two signals separated

Note: With the above test setup, two signals of -10 dBm, and 6 MHz apart from each other are applied to the analyzer. To prevent interference between the two signal-generator outputs, the power splitter used must be a high isolation type.

(3) Read the two signal distortion level from the display, to make sure that it is within the specification. (Fig. 12-35)

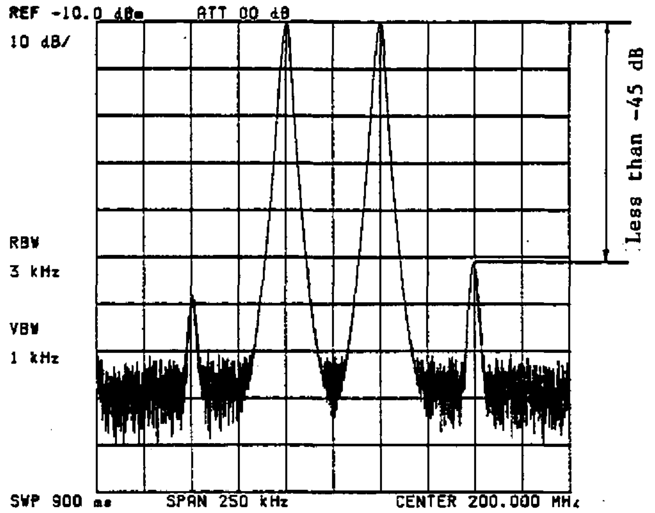
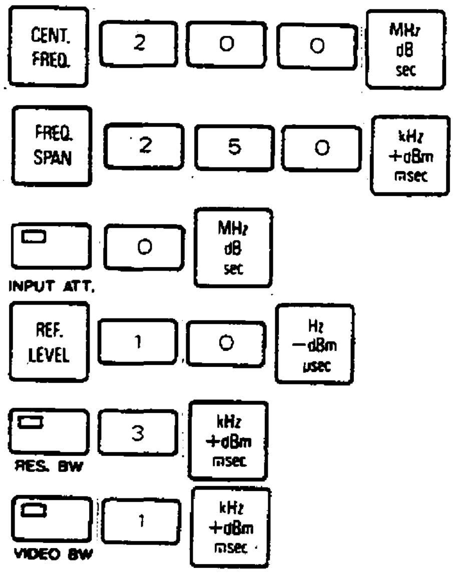


Fig. 12-36 Spurious response two signal distortion test

(4) Update the panel setup on the instrument as follows, and check to make sure that the two-signal distortion level is within the specification when the difference in the two signal frequencies is 50 kHz: (Fig. 12-36)



Output frequency of SG1: 199.975 MHz

Output frequency of SG2: 200.025 MHz

12-4-10. Gain Compression

Specification: Less than 1 dB at an input level of 0 dBm with the input attenuator set at 0 dB.

Required instrument:
- Signal generator
- External attenuator covering 0 to 110 dB at 10 dB steps.

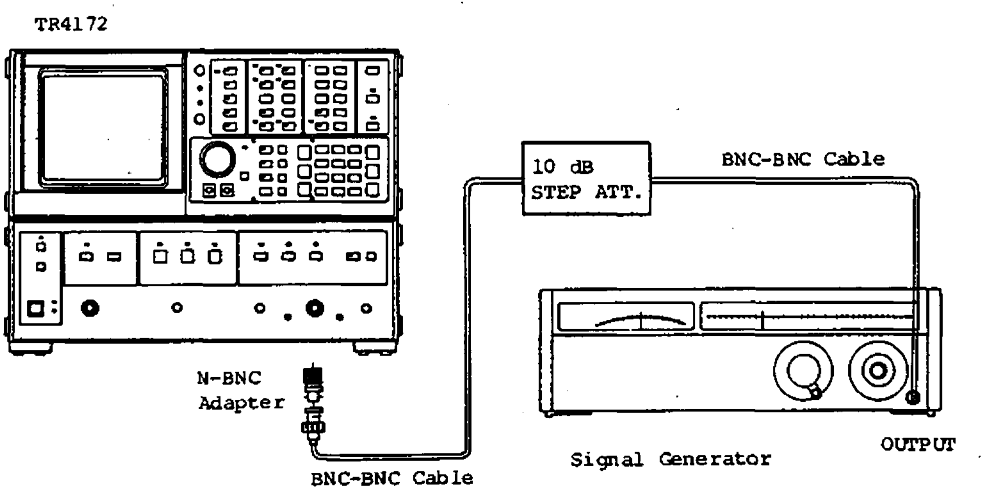
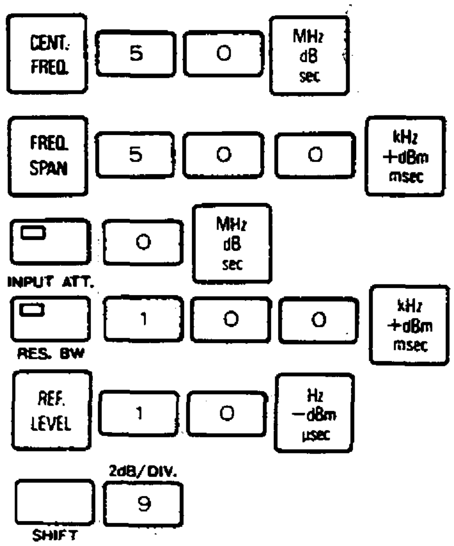


Fig. 12-37 Gain compression test setup

(1) While the instrument is in the initial default state, set it up as follows:



(2) Apply an SG output of 50 MHz, 0 dBm to the input of the analyzer via the external attenuator. Set the external attenuator to 10 dB of attenuation. Press [PEAK SEARCH] to read the marker readout for the input signal level (-10 dB).

(3) Set the external attenuator to 0 dB of attenuation and apply an input signal level of 0 dBm to the analyzer. Press [REF. LEVEL] [0] [MHz dB sec] and [PEAK SEARCH] to read the signal level.

(4) Add 10 dB to the marker readout of the above (2) to assume a level without a gain compression. Compare this level with the level readout obtained when an input signal of 0 dBm is applied to the analyzer's input, to check that the gain compression is less than 1 dB.

12-4-11. Input Attenuator Switching Accuracy

Specification: Less than ±0.5 dB at 50 MHz over 0 to 50 dB

Required instruments: • Signal generator
• External attenuator of 10 dB stepping

(1) While the instrument is in the initial default state, set it up as follows:

[CENT. FREQ] [5] [0] [MHz dB sec]

[FREQ. SPAN] [1] [0] [0] [kHz +dBm msec]

[RES. BW] [1] [0] [0] [kHz +dBm msec]

[VIDEO BW] [1] [0] [0] [kHz +dBm msec]

[INPUT ATT.] [0] [MHz dB sec]

[REF. LEVEL] [5] [0] [.] [5] [Hz -dBm μsec]

[SHIFT] [5] (0.1dB/DIV.)

(2) Apply an SG output of 50 MHz in frequency and 0 dB in level to the analyzer input via an external attenuator with an attenuation of 50 dB.

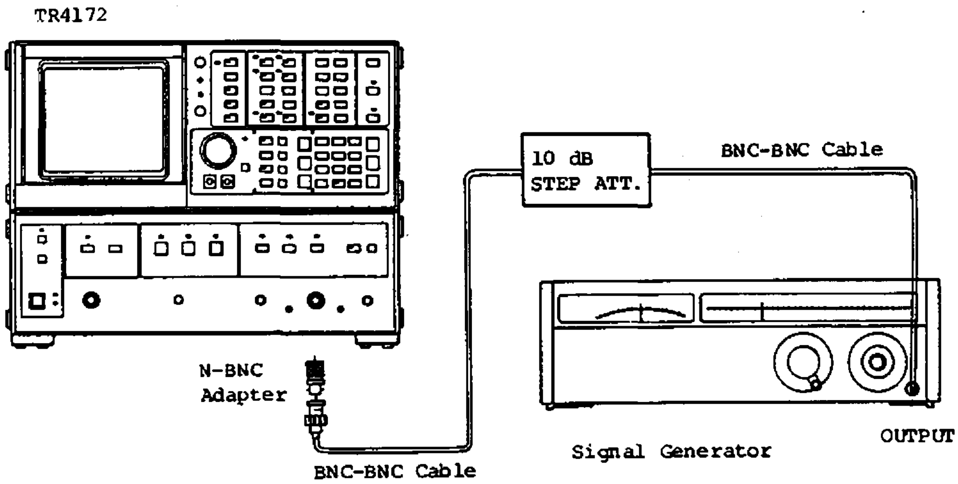


Fig. 12-38 Input attenuator switching accuracy setup

(3) Adjust the SG output level until the input signal response is positioned in the center of the vertical graticule.

(4) Press [INPUT ATT.] [1] [0] [MHz dB sec] to set the external attenuator to 40 dB of attenuation. Verify that the signal level is within ±5 division (0.5 dB) from the center of the vertical scale.

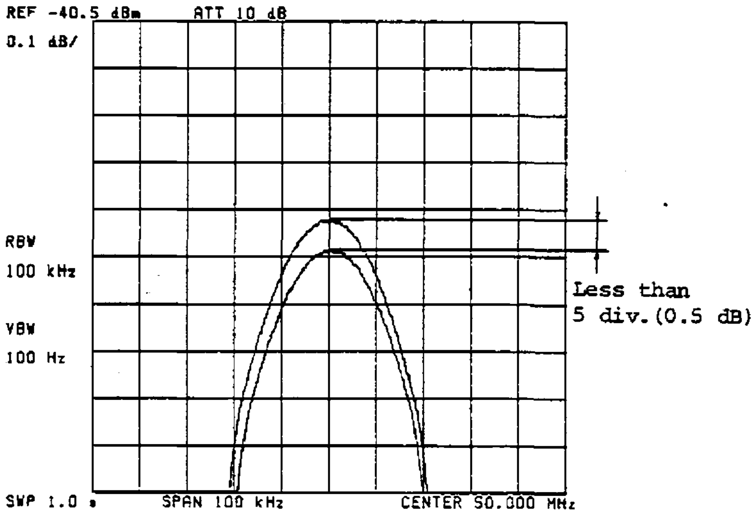


Fig. 12-39 Input attenuator switching accuracy test

(5) Subsequently change both input attenuator and external attenuator settings each by 10 dB sequentially as shown in the following table. Verify that the attenuator accuracy is within ±5 divisions (0.5 dB) with respect to 0 dB over each settings.

Table 12-7

INPUT ATT.	0 dB	10 dB	20 dB	30 dB	40 dB	50 dB
EXT. ATT.	50 dB	40 dB	30 dB	20 dB	10 dB	0 dB

12-4-12. Calibration Output Level Accuracy

Specification: -20 dBm ±0.3 dB over 20°C to 30°C

Required instrument: Power meter

(1) Connect a power meter to the CAL. OUT. connector on the front panel of the instrument for direct CAL. OUT. level checking.

(2) The power meter used should be calibrated at 50 MHz. Verify that the CAL. OUT. level is within -20 dBm ±0.3 dB.

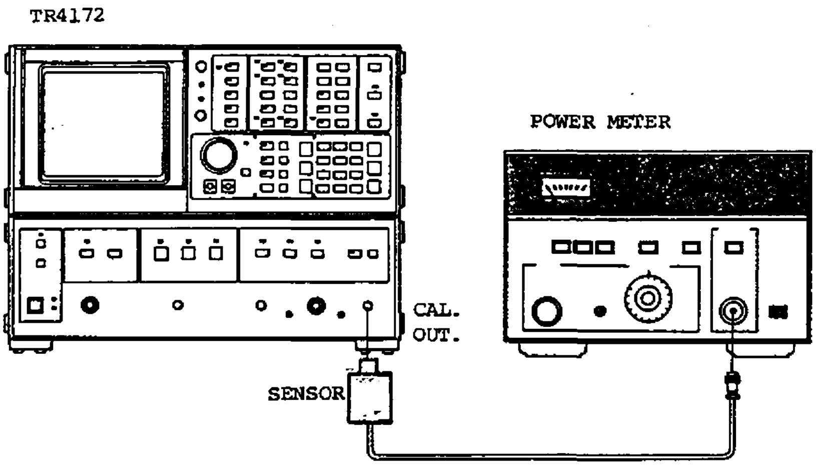


Fig. 12-40 CAL. OUT. level measurement setup

12-5. TRACKING GENERATOR PERFORMANCE CHECK

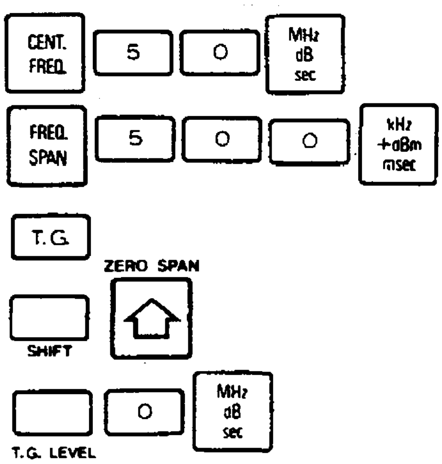
This paragraph describes the performance check procedures for the built-in tracking generator.

12-5-1. T.G. Output Level Accuracy

Specification: Within 0 dBm ±1.0 dB at an output frequency of
50 MHz, with the T.G. attenuator set at 0 dB.

Required instrument: Power meter

(1) While the instrument is in the initial default condition, set it up as follows:



(2) Measure the T.G. output level with a power meter calibrated at 50 MHz.

(3) Verify that the measured level is within the specification of 0 dBm ±1.0 dB.

(4) Now proceed with T.G. output frequency response check.

12-5-2. T.G. Output Frequency Response

Specification: Within ±0.7 dB over 400 kHz to 1500 MHz
Within ±1 dB over 400 kHz to 1800 MHz
Both with respect to a 50 MHz level, with the T.G. attenuator set at 10 dB attenuation.

Required instrument: Power meter

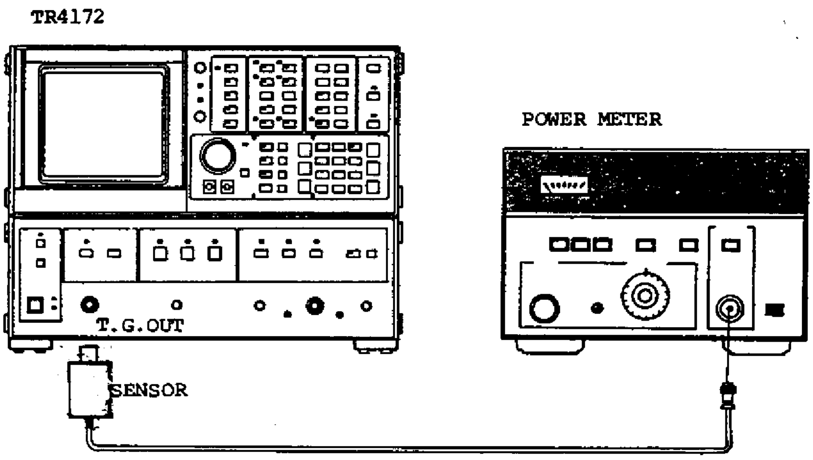
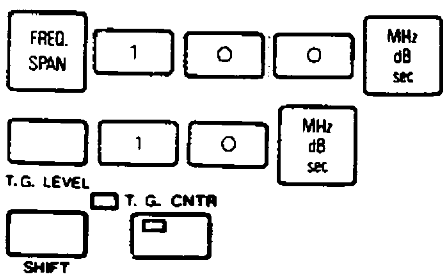


Fig. 12-41 T.G. output level measurement setup

(1) After checking the T.G. output level, set up the instrument as follows:



(2) Use the output level at 50 MHz as a reference.

(3) Next, press [CENT. FREQ.] [4] [0] [0] [kHz +dBm msec] . Use the DATA knob to sweep the center frequency from 400 kHz through 1800 MHz, and verify that the frequency response is within ±0.7 dB over 400 kHz to 1500 MHz, and within ±1 dB over 400 kHz to 1800 MHz.

12-5-3. T.G. Output Level Switching Accuracy (T.G. ATT. Switching Accuracy)

Specification: Within ±0.5 dB at 50 MHz over 0 to 50 dB

Required instrument: Attenuator covering 0 to 110 dB attenuation at 10 dB steps

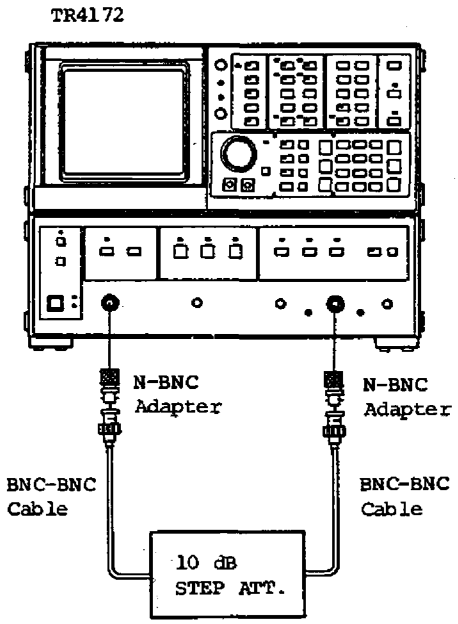


Fig. 12-42 T.G. attenuator accuracy check setup

(1) While the instrument is in the initial default condition, set it up as follows:
Connect the T.G. output to the INPUT-1 connector via an external attenuator 50 dB of attenuation, then enter as follows:

[CENT. FREQ] [5] [0] [MHz dB sec]

[FREQ. SPAN] [5] [1] [0] [kHz +dBm msec]

[RES. BW] [3] [kHz +dBm msec]

[VIDEO BW] [1] [0] [0] [Hz −dBm μsec]

[SWEEP TIME] [5] [0] [0] [kHz +dBm msec]

[SHIFT] [ZERO SPAN ⇧]

[T.G]

[T.G. LEVEL] [0] [MHz dB sec]

[INPUT ATT.] [0] [MHz dB sec]

[REF. LEVEL] [5] [0] [Hz −dBm μsec]

[SHIFT 5] [0.1dB/DIV. 5]

(2) Next, [REF. LEVEL]. Adjust the DATA knob until the T.G. output signal response is positioned in the center of the vertical scale. Use this signal level as a reference for the following measurements.

(3) Press [T.G. LEVEL] [1] [0] [MHz dB sec] to set the T.G. attenuator to 10 dB. Set the external attenuator to 40 dB. Verify that the then signal level is within ±5 divisions (0.5 dB) with respect to the reference level obtained just above.

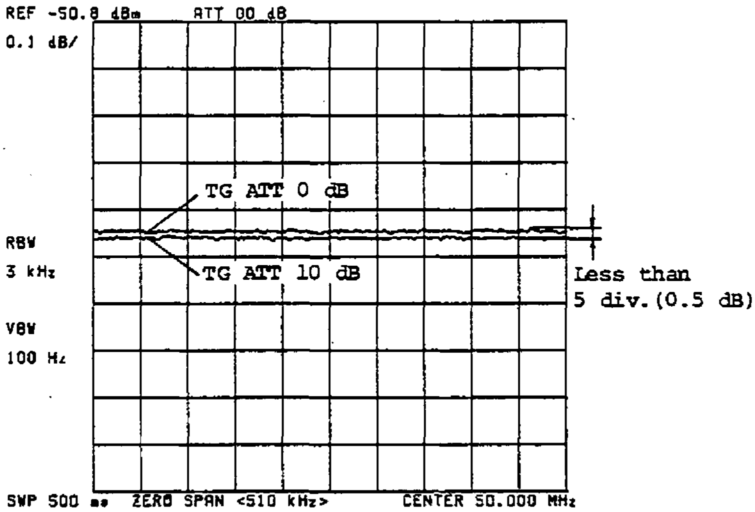


Fig. 12-43 T.G. attenuator accuracy

(4) Subsequently change the T.G. and external attenuator settings each by 10 dB as shown in the following table, and make sure that each signal level is within ±5 divisions (0.5 dB) with respect to the reference level, over the T.G. attenuator settings of 0 to 50 dB.

Table 12-8

TG. ATT.	0 dB	10 dB	20 dB	30 dB	40 dB	50 dB
EXT. ATT.	50 dB	40 dB	30 dB	20 dB	10 dB	0 dB

12-5-4. Tracking Generator Output Spurious

Specification: Higher harmonics: Less than -20 dB

Spurious other higher harmonics:

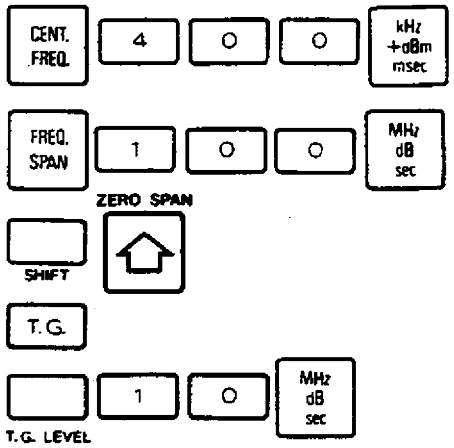
Less than -30 dB over 400 kHz to 1500 MHz

Less than -25 dB over 1500 MHz to 1800 MHz

Nonharmonic spurious which crosses the fundamental signal component: Less than -30 dB over 400 kHz to 1800 MHz

Required instrument: Spectrum analyzer having a frequency response up to 4 GHz

(1) While the instrument is in the initial default condition, set it up as follows:



(2) Apply the T.G. output to the input of a spectrum analyzer having direct observation capability up to 4 GHz.

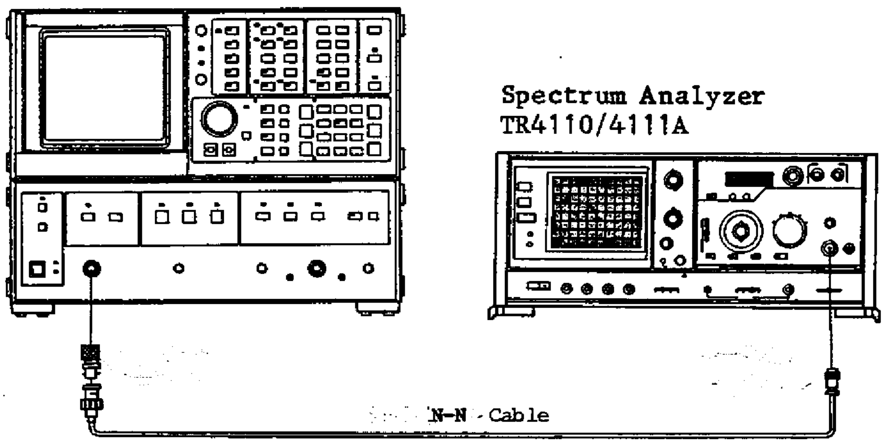


Fig. 12-44 T.G. output spurious test setup

(3) Press [CENT. FREQ.]. While turning the DATA knob to sweep the center frequency from 400 kHz through 1800 MHz, verify that harmonic and nonharmonic spurious levels are within the specifications.

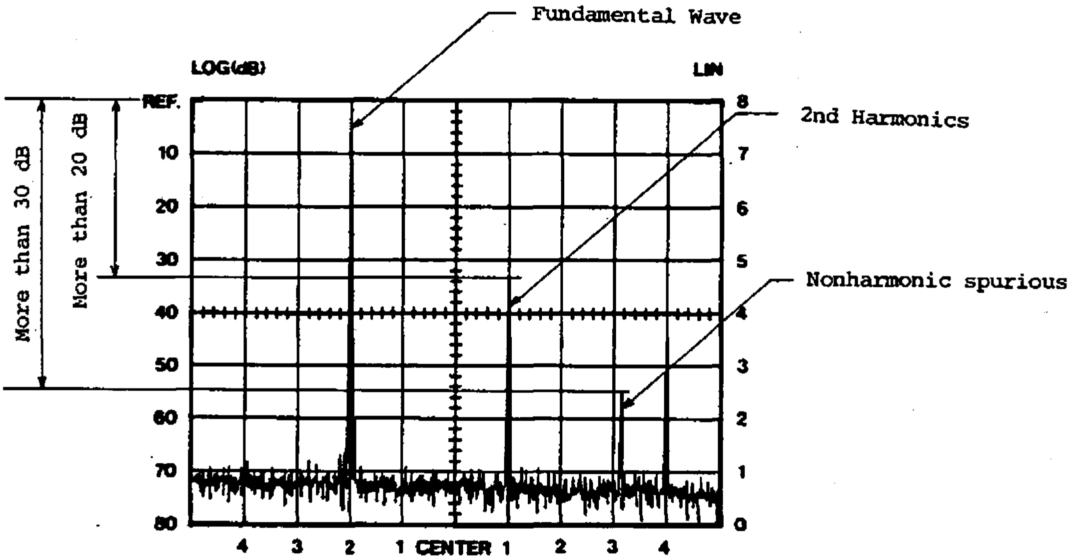


Fig. 12-45 T.G. output spurious test

12-5-5. Tracking generator Frequency Tracking

Specification: Drift: 30 Hz/min

300 Hz/10 min

The peak must be obtained at a resolution bandwidth of 10 Hz.

(1) While the instrument is in the initial default condition, set it up as follows:

Connect the T.G. output to the INPUT-1 of the TR4172 Analyzer.

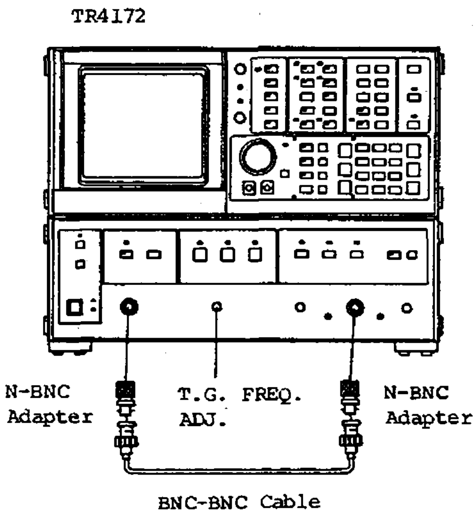
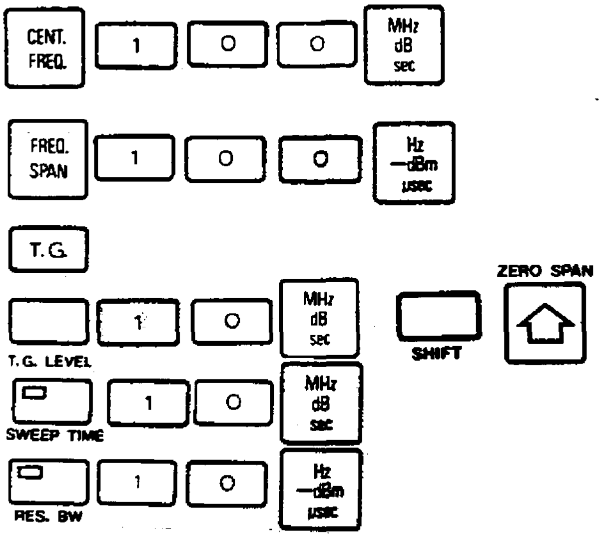


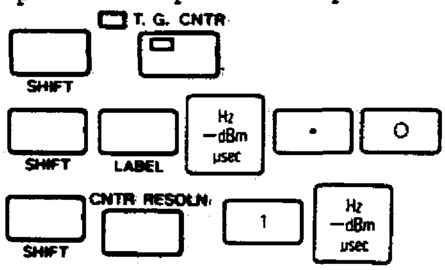
Fig. 12-46 T.G. tracking setup

Now enter as follows:



(2) Adjust the front control named T.G. FREQ. ADJ. to make sure that the peak of the T.G. output level can be obtained on the display.

(3) Update the panel setup as follows:



(T.G. count mode)

(4) Count the T.G. output frequency and verify that the frequency drifts, 1 and 10 minutes later are both within the specification.

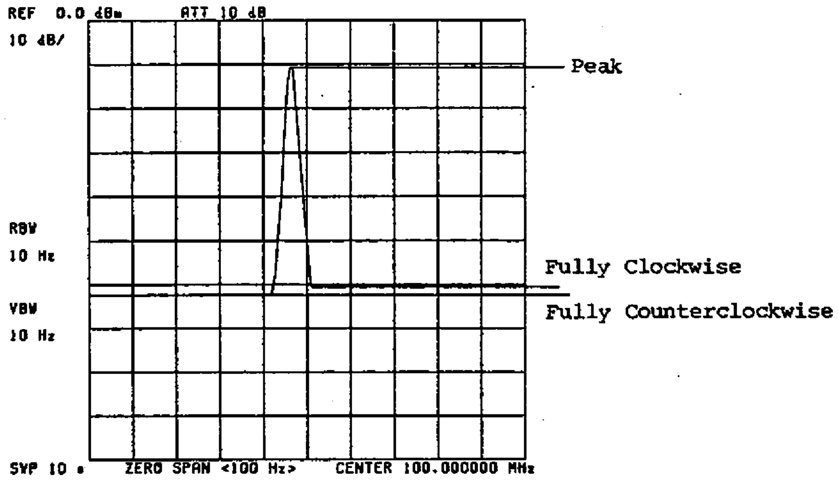
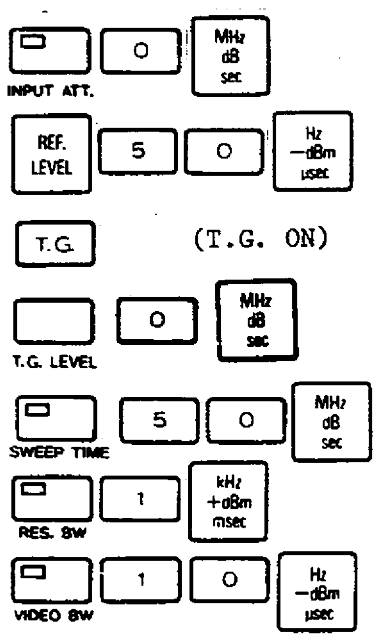


Fig. 12-47 T.G. frequency tracking

12-5-6. T.G. Leakage Level

Specification: Less than -100 dBm over 0 to 1500 MHz
Less than -95 dBm over 0 to 1800 MHz

(1) While the instrument is in the initial default state, set it up as follows. Leave both the T.G. OUTPUT and INPUT-1 connectors open (unplug the adapter if plugged).



(2) With no signal applied to the input of the analyzer, observe the response on the display over 0 to 1800 MHz to verify that no response exceeding the specification is observed. Ignore the "UNCAL" message, if appears.

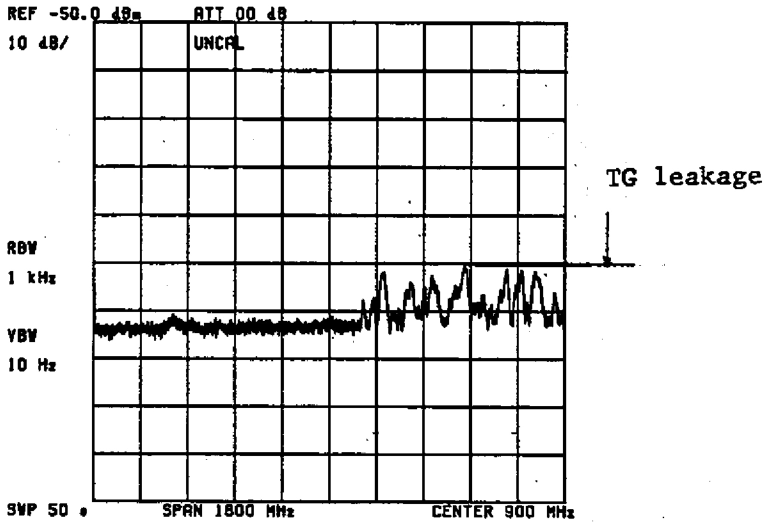


Fig. 12-48 T.G. output leakage

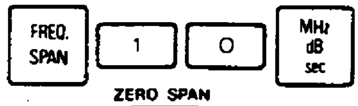
12-6. PHASE AND GROUP DELAY DISPLAY PERFORMANCE CHECK

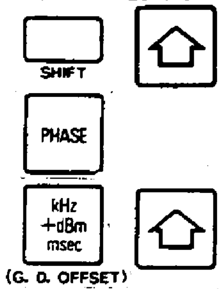
This paragraph describes check procedures for the phase and group delay (G.D.) display features contained in the instrument.

12-6-1. Phase Display Range Accuracy

Specification: Within ±3% at each display range ±180 ±5 deg.

(1) While the instrument is in the initial default state, set it up as follows:
Connect the TRACKING GENERATOR OUTPUT connector to the INPUT-1 connector, then enter as follows:

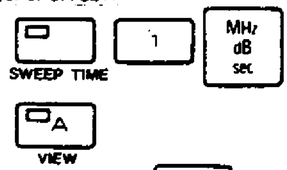




(Zero frequency span)

(PHASE mode)

(To set G.D. Offset to "400")



(2) Operate PEAK SEARCH and then SHIFT NEG. PEAK S. to read the peak and bottom values on the display. Verify that these values are within the specification of 180 ± 5 deg. and -180 ± 5 deg. respectively.

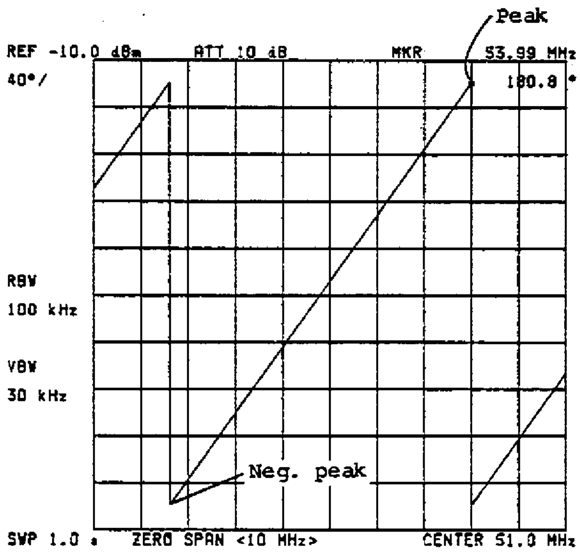
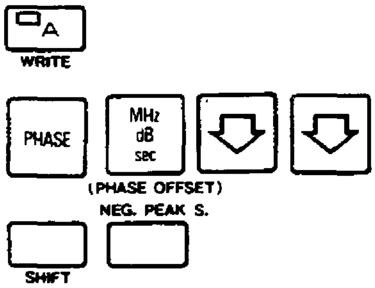


Fig. 12-49 Phase display range

12-6-2. Phase Offset

Specification: Must be variable over ±250 deg.

(1) After verifying the phase display range, proceed with the following panel setup:



(Set phase offset to 0)

(2) While slowly turning the DATA knob to increase phase offset from 0 to 4096, verify that the marker on the display moves over more than 500 deg. as shown below:

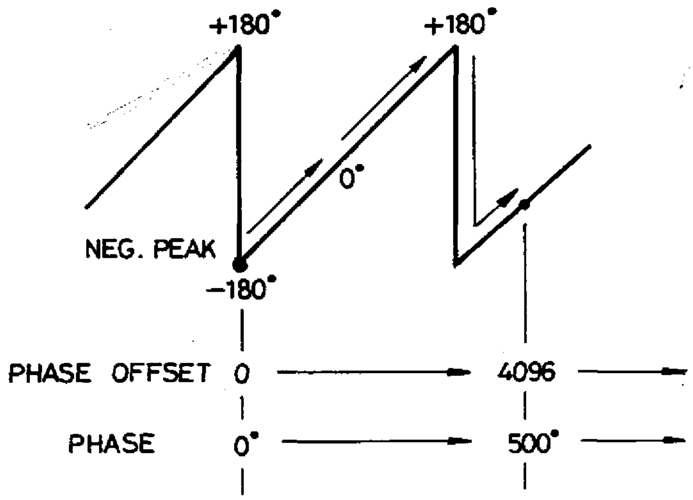
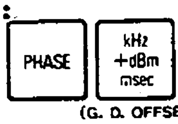


Fig. 12-50 Phase offset test

12-6-3. Group Delay Offset

Specification: Must be variable over more than 3600 deg.

(1) After verifying the phase offset, proceed with the following setup:

Press  and then use  to set group delay offset to 2000.

(2) Press [kHz +dBm msec] (G. D. OFFSET) again and then use [⇩] to set group delay offset fine to 0.

(3) Now press [MHz dB sec] (PHASE OFFSET). Adjust phase offset with the DATA knob so that the switching point from +180 deg. is aligned to the leftmost graticule as shown below:

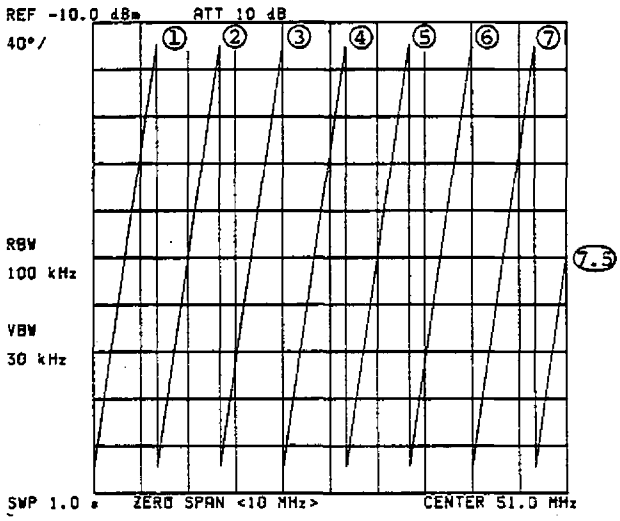


Fig. 12-51 Group Delay Offset test

(4) Check to make sure that there are 7.5 saw-tooth waves (360° x 7.5 = 2700 deg.) between the leftmost and rightmost graticules. G.D. offset covers from 0 to 4096, which allows for phase variation of more than 5400 deg., since G.D. of 2000 corresponds to 2700 deg.

12-6-4. Group Delay Offset Fine

Specification: 50.6 deg. $\pm$2.5 deg.

(1) After verifying G.D. offset, proceed with the following setup:

Press [PHASE] [kHz +dBm msec] (G. D. OFFSET) and then use [⇩] to set G.D. offset to 0.

(2) Press [MHz/dB/sec] (PHASE OFFSET). Adjust phase offset with the DATA knob until the phase response is positioned to the center of the screen.

(3) Press [PHASE]. Set phase to 8 deg./div. with the DATA knob.

(4) Press [PHASE] [kHz/+dBm/msec] (G. D. OFFSET) and then again [kHz/+dBm/msec] (G. D. OFFSET). Adjust the DATA knob to set G.D. offset fine to 250.

(5) Then press [ ] (PEAK SEARCH) [ ] (Δ) [ ] (SHIFT) [ ] (NEG. PEAK S.). Verify with the delta marker that the deviation read is within 50.6 ±2.5 deg.

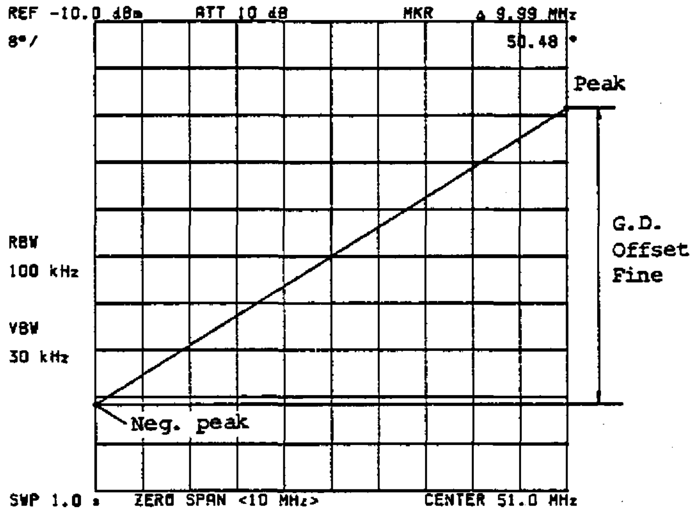


Fig. 12-52 G.D. offset fine

12-6-5. Group Delay Display Range Accuracy

Specification: Within ±3% at frequency span of 10 MHz, 40 deg./div. (20°C to 30°C)

(1) After verifying G.D. offset fine, proceed with this check.

First press [PHASE], then adjust the DATA knob to set the phase to 40 deg./div.

(2) Press [kHz/+dBm/msec] (G. D. OFFSET) and then use [⇧] to set G.D. offset to "400".

(3) Press [GROUP DELAY] to obtain group delay display, then press [□A] (VIEW) to store the waveform.

(4) Use the delta marker to read the delay time shown in the following figure, and verify that the readout value is within ±3% (96 ns) of the display range.

(5) Press [A] (WRITE)

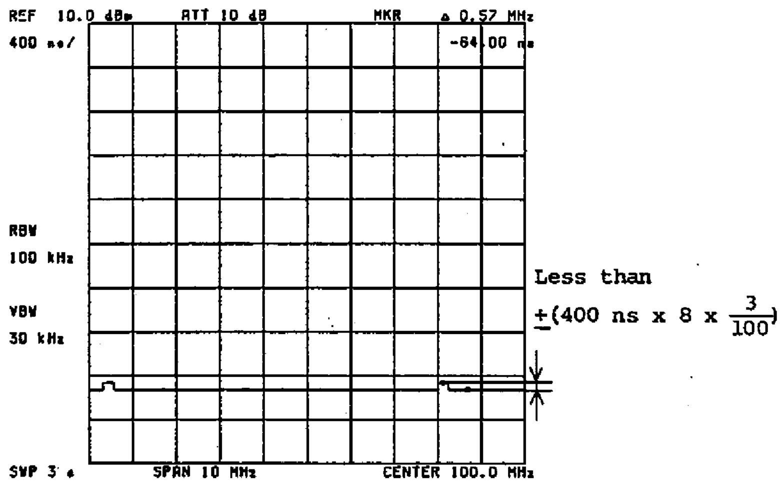


Fig. 12-53 Group Delay display range accuracy

12-6-6. Phase Stability

Specification: Less than 0.1 deg. p-p/100 ms at frequency span of 10 MHz, resolution bandwidth of 100 kHz, and video bandwidth of 30 kHz

(1) After verifying G.D. display range accuracy, proceed with this check. First press [PHASE] [kHz +dBm msec] (G. D. OFFSET), then use [⇩] to set G.D. offset to 0.

(2) Press [kHz +dBm msec] (G. D. OFFSET) again. Use [⇩] to set G.D. offset fine to 0.

(3) Press [MHz dB sec] (PHASE OFFSET), then adjust the DATA knob until the signal response is positioned to the center of the vertical scale.

(4) Press [PHASE], then use the DATA knob to set the phase to 4 deg./div.

(5) Press [MHz dB sec] (PHASE OFFSET) again, then adjust the DATA knob until the signal response is positioned to the center of the vertical scale.

(6) Press PHASE, then use the DATA knob to set the phase to 0.2 deg./div.

(7) Verify that the ripple within one division of the horizontal scale is less than 0.5 div. (0.1 deg.) as shown below.

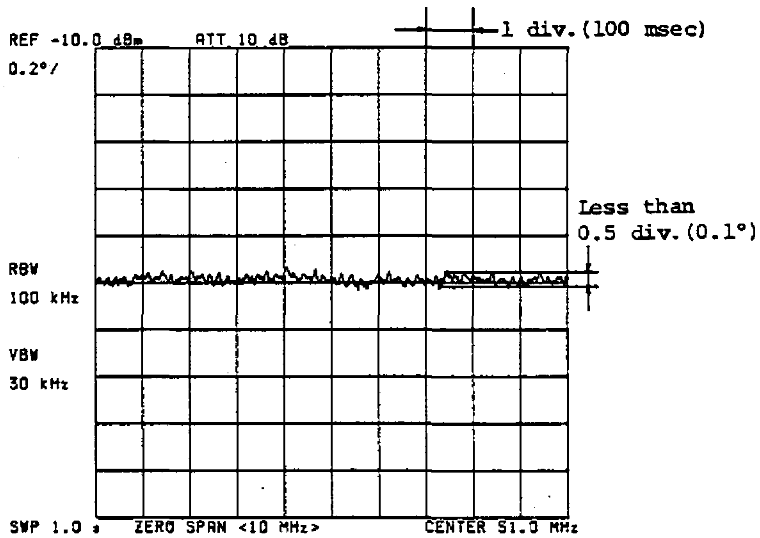


Fig. 12-54 Phase stability check

12-7. SUPPLY VOLTAGE VARIATION CHECK

Specification: ±10% (+4%, -10% for 240 Vac)

Required instruments: Slidac transformer

AC voltmeter (for voltage monitoring)

(1) While monitoring the AC output voltage of the slidac transformer with an AC voltmeter, set it to the specified supply voltage.

(2) Plug the analyzer to the AC outlet on the slidac transformer.

(3) Power the instrument. While it is in the initial default condition, apply the CAL. OUT. signal to the input.

(4) While varying the slidac transformer output voltage from -10% to +10% (+4% for 240 V) of the specified supply voltage, verify that nothing changes in the display information.

		Test item		Specifications	Date
Performance test requiring no measuring instruments	1	Impact test		Lift the front bottom of the instrument to a height of 3 cm from the test deck surface, then drop it on the deck, and and verify that the instrument operates normally. Carry out similar drop test for the rear and both sides of the instrument.	
	2	Display area size		100 x 120 mm or more	
	3	Pattern and orthogonal distortion		Within ±1 mm	
	4	Trace align		Variable over more than ±3 deg.	
	5	Intensity and focus			
	6	Frequency span accuracy	When freq. span >500kHz	Within ±3%	
			When freq. span ≦500kHz	Within ±5%	
	7	Marker display accuracy	NORMAL	Within center frequency accuracy ±accuracy of the span between marker and center frequency	
			T.G. Counter	Same as center frequency accuracy.	
			Count	Master oscillator accuracy x display frequency ±2 counts or less	

		Test item			Specifications	Date
Performance test requiring no measuring instruments	8	Resolution bandwidth accuracy	3 dB bandwidth	1 MHz	Within 1 MHz ±200 kHz	
				300 kHz	Within 300 kHz ±60 kHz	
				100 kHz	Within 100 kHz ±20 kHz	
				30 kHz	Within 30 kHz ±6 kHz	
				10 kHz	Within 10 kHz ±2 kHz	
				3 kHz	Within 3 kHz ±600 Hz	
				1 kHz	Within 1 kHz ±200 Hz	
				300 Hz	Within 300 Hz ±60 Hz	
				100 Hz	Within 100 Hz ±20 Hz	
				30 Hz	Within 30 Hz ±6 Hz	
				10 Hz	Within 10 Hz ± 2 Hz	
			Q.P. option 6 dB bandwidth	120 kHz	Within 120 kHz ±20 kHz	
				9 kHz	Within 9 kHz ±1 kHz	
				200 Hz	Within 200 Hz ±20 Hz	
	9	Resolution bandwidth selectivity	60 dB bandwidth	1 MHz	<10 MHz	
				300 kHz	< 3 MHz	
				100 kHz	< 1.3 MHz	
				30 kHz	< 390 kHz	
				10 kHz	< 130 kHz	
				3 kHz	< 39 kHz	
				1 kHz	< 13 kHz	
				300 Hz	< 3.9 kHz	
				100 Hz	< 1.3 kHz	
				30 Hz	< 390 Hz	
				10 Hz	< 130 Hz	

		Test item		Specifications	Date
Performance test requiring no measuring instruments	10	Resolution bandwidth switching level accuracy	With reference to 300 kHz resolution bandwidth before error correction.	Within ±1.0 dB	
	11	Residual FM	When freq. span ≧ 510 kHz	Within 8 kHz p-p/sec.	
			When freq. span < 50 kHz	Within 2Hz p-p/sec.	
	12	Frequency stability	When freq. span < 50 kHz	Within 30Hz p-p/min.	
	13	Noise sideband	30 kHz from carrier with 1 kHz resolution bandwidth	Less than -80 dB	
			20 kHz from carrier with 1 kHz resolution bandwidth	Less than -75 dB	
	14	Adjacent spurious	From carrier	Less than 70 dB	
	15	Residual response	No input signal with input ATT. set at 0 dB	Less than 100 dBm	
	16	Noise level / Center freq. > 1 MHz with video BW of 1 Hz	Resolution bandwidth 1 MHz	Less than -80 dBm	
			Resolution bandwidth 300 kHz	Less than -85 dBm	
			Resolution bandwidth 10 kHz	Less than -100 dBm	
			Resolution bandwidth 3 kHz	Less than -105 dBm	
			Resolution bandwidth 10 Hz	Less than -130 dBm	
	17	Fine tune level deviation		Within 0.5 dBp-p	
	18	Counter operation	Operating frequency	400 kHz to 1500 MHz	
			TG 3RD LO 23 M VCO 3RD LO 2 M VCO TG 200 M IF 1ST LO IF 2ND LO 204M 3RD LO 153 M 4TH LO 33 M 1ST LO AUTO	Should normally count each local frequency.	

		Test item				Specifications	Date
Performance test requiring no measuring instruments	19	Analog sweep	Zero frequency span with sweep time of 19 ms	V. axis deviation		Within ±0.2 div.	
				H. axis deviation		0-0.5 div.	
	20	Reference level variable range				More than 4 dB p-p	
	21	GP-IB check					
	22	Key operation check					
Performance test requiring measuring instruments	23	Sweep time accuracy		20 msec to 1000 sec		Within ±5%	
				100 µs to 1000 sec under zero frequency span		Within ±5%	
	24	TRIGGER		INTERNAL			
				LINE			
				VIDEO		Trigger point must be variable over 1 div.	
				EXTERNAL			
				SINGLE		Sweep only once upon each key operation	
	25	Center frequency accuracy				Within ±(1% of span ±20 Hz)	
	26	Vertical scale linearity	Logarithmic scale	In 0-0.8 dB range	0.1 dB/DIV	Within ±0.2 dB/1 DIV	
				In 0-95 dB range	1 dB/DIV	Within ±1 dB/1 DIV	
				In 0-95 dB range (20°C to 30°C)	10 dB/DIV	Within ±1 dB/1 DIV	
				In 0-95 dB range (0°C to 40°C)	10 dB/DIV	Within +1.5 dB/1 DIV	
			Linear scale			Within ±3% of the reference level	

		Test item			Specifications	Date
performance test requiring measuring instruments	27	Reference level accuracy			Within ±1.0 dB	
	28	Frequency response		Between 50 Hz and 1 GHz	Within 2 dBp-p	
				Between 50 Hz and 1.8 GHz	Within 3 dBp-p	
				Between 400 kHz and 1.8 GHz after error correction	Within ±0.7 dB	
	29	Spurious response	2nd harmonic	CF 20 MHz with -10 dBm input	Less than -60 dB	
				CF 20 MHz with -10 dBm input	Less than -45 dB	
			Two-signal distortion	Separation > 5 MHz with -10 dBm two signals	Less than -50 dB	
				Separation ≤ 5 MHz with -10 dBm two signals	Less than -45 dB	
	30	Gain compression		Under 0 dBm input with Input ATT. set at 0 dB	Less than 1 dB	
	31	Input ATT. switching accuracy		Over 0 to 50 dB at 50 MHz	Within ±0.5 dB	
	32	CAL. signal level accuracy		20-30°C	Within -20 dBm ±0.3 dB	
T.G. performance test	33	T.G. output level accuracy		At 50 MHz output frequency	Within 0 dBm ±1.0 dB	
	34	TG output freq. response	With reference to 50 MHz output freq. with TG ATT. set at 10 dB	Over 400 kHz to 1500 MHz	Within ±0.7 dB	
				Over 400 kHz to 1800 MHz	Within ±1 dB	
	35	TG attenuator switching accuracy		0-50 dB at 50 MHz	Within ±0.5 dB	

		Test item			Specifications	Date
T.G. performance test	36	TG output spurious	Higher harmonics		Less than -20 dB	
			Non-harmonics	400 kHz-1500 MHz	Less than -30 dB	
				1500 MHz-1800 MHz	Less than -25 dB	
			Non-harmonics that cross the fundamental wave	400 kHz-1800 MHz	Less than -30 dB	
	37	TG freq. tracking (drift)	In 1 min		Less than 30 Hz	
			In 10 min		Less than 300 Hz	
	38	TG signal leakage	0-1500 MHz		Less than -100 dBm	
			0-1800 MHz		Less than -95 dBm	
Phase, Group Delay performance test	39	Phase display range accuracy	In each display range		Within ±180 ±5 deg.	
	40	Phase offset variable range			More than ±250 deg.	
	41	Group delay offset variable range			More than 3600 deg.	
	42	Group delay offset variable range			Within 50.6 ±2.5 deg.	
	43	Group delay display range accuracy	At freq. span of 10 MHz with 40 deg/div.		Within ±3%	
	44	Phase stability	Freq. span 10 MHz, Resolution BW 100 kHz, Video BW 30 kHz, and within 100 ms		Within 0.1 deg. p-p	
	45	Supply voltage variation	For 100 Vac		±10%	
			For 240 Vac		+4%, -10%	

MEMO

SECTION 13
TROUBLESHOOTING

13-1. GENERAL

This section provides flowchart-based troubleshooting procedures for the TR4172 Spectrum Analyzer. After the analyzer is serviced, conduct a performance test, then calibrate the analyzer. For quick parts identification, part numbers and symbols printed or inscribed on schematic diagrams and PC boards are used throughout.

13-2. PREPARATION

This paragraph describes the measuring instruments, tools, and jigs required for troubleshooting and some general precautions. It is recommended that the instruments listed in Table 13-1 or their equivalent be used.

Table 13-1 Measuring instruments required for troubleshooting

No.	Instrument	Specifications		Recommended model
1	Signal generator	Frequency range: Output level: Output impedance:	10 - 500 MHz +10 to -30 dBm 50 Ω	
2	Frequency counter	Frequency range: Output level: Stability:	10 MHz - 4 GHz -20 dBm 2×10^{-8}/day	TR5211A (ADVANTEST)
3	Digital multimeter	Measurable range: Accuracy: Input impedance:	0 to ± 1000 V ± 0.1 % 10 MΩ	TR6841 (ADVANTEST)
4	DC high voltage probe	Measurable range:	-3 to +12 kV	TR1116 (ADVANTEST)
5	Spectrum analyzer	Frequency range: Sensitivity: Resolution:	100 kHz to 4 GHz -120 dBm 30 Hz to 300 kHz	TR4110/4111A (ADVANTEST)
6	FET probe	Measurable range:	DC to 500 MHz	P6202 (Tektronix)
7	Oscilloscope	Frequency range: Sensitivity:	DC to 100 MHz 5 mV	Model 465 (Tektronix)

Table 13-2 lists the jigs and cables required for troubleshooting; these are available in the Maintenance kit. Table 13-3 lists the necessary tools.

Table 13-2 Jigs required for troubleshooting (Maintenance Kit A08803)

No.	Item	Stock No.	Quantity	Remarks
1	Interconnecting cable	MC-36	1	BNC-UM
2	Interconnecting cable	MC-37	1	BNC-SMA
3	Interconnecting cable	MM-14	3	SMA-SMA
4	Interconnecting cable	MM-17	2	UM-UM
5	Interconnecting cable		1	UM open
6	UM-UM linear adapter		1	UM-QA-JJ
7	SMA-SMA adapter		1	HRM-501
8	Extender-1		1	28 pin W x 2
9	Extender-2		1	28 pin W
10	Extender-3		1	22 pin W long
11	Extender-4		1	22 pin W short
12	Interconnecting cable	MC35B	1	Amphenole 50 pin
13	Interconnecting cable		1	RF 1.5 m
14	Interconnecting cable		1	SMA-open
15	Extension cable (CRT)		3	5 pin x 30 cm
16	Standard pattern scale		1	
17	SMA wrench		1	

Table 13-3 Tools required for troubleshooting

1) Phillips screwdriver (3 and 4 mm)
2) Standard screwdriver (2 and 4 mm)
3) Allen wrenches
4) Soldering iron (300 W)
5) Tweezers
6) Radio pliers
7) Pinchers
8) Box drivers (5 mm)
9) Slug adjusting screwdriver

13-2-1. General Precautions

(1) The following troubleshooting procedures is designed for the reference of service personnel and electronic technicians who have considerable skill and experience in servicing the spectrum analyzer and similar instruments.

(2) The local line voltage at which the instrument should be operated is 100/120/220 Vac ±10% or 240 Vac +4%, -10% (50 or 60 Hz).

(3) The power cable has a 3-pronged plug; the middle prong is ground. If a 2-pronged adapter is used for power connection, connect the ground lead of the adapter or the GND terminal on the rear of the instrument to ground.

(4) The troubleshooting site should be free from excessive dust, vibration, and noise.

(5) When accessing internal parts of the instrument, be sure to set the POWER switch to STANDBY. The instrument power should also be switched off whenever its PC board assembly is plugged in or out.

(6) When making measurements with an oscilloscope or a digital multimeter, exercise care to avoid shorting adjacent terminals or part leads with the probes.

(7) For on-board parts replacement, use a 20 W to 30 W soldering iron. Resoldering to part leads should be made in the shortest possible time. When replacing a multipin device, use a solder sucker.

(8) Replacement parts should be those listed in the attached parts list or equivalent. If replacement is required for the parts marked with an asterisk in the parts list, contact your nearest ADVANTEST representative.

(9) The instrument contains high-voltage circuits. When accessing the internal high-voltage module, exercise caution to prevent electrical shock. Do not access any internal parts of the instrument within 5 minutes after the power is switched off.

13-3. REMOVING/MOUNTING PC BOARD ASSEMBLY AND BLOCKS

PC board assemblies and blocks should be removed or remounted according to the mechanical assembly illustrations on Section 14 and photos in this section.

13-3-1. Separating the Display Section from the RF Section

Disconnect all connecting cables between the Display and RF Sections, then remove the retention screws from the rear of the instrument. Pull the Display Section forward until the front joints are unlocked, then separate the Display Section from the RF Section.

13-3-2. Removing PC Board Assemblies and Blocks from the Display Section

(1) DISPLAY POWER 1 (BGC-010198)
Pull out the PC board assembly shown in Figure 13-1; remount it in the same slot via Extension Card as needed.

(2) DISPLAY POWER 3 (BGC-010369)
Remove the four retention screws shown in Figure 13-1; then pull out the PC board assembly; remount it in the same slot via Extension Card as needed.

(3) DISPLAY POWER 2 (BGB-010199)
Remove the DISPLAY POWER 3 board as described in step 2, remove the two connector retention screws, then pull out the connector from the DISPLAY POWER 2 board. Remove the board from its slot and check its components as needed.

(4) DISPLAY POWER 4 (BLB-010202)
Remove the left panel from the Display Section, then, referring to the Figure 14-2 Mechanical assembly illustration in Section 14, remove the DISPLAY POWER 4 board from its slot.

(5) CRT DRIVER (BGK-010184)
Pull out the board shown in Figure 13-1. Remount it in the same slot using the Extension Card when necessary. Each connector should be plugged into the board by extension cables.

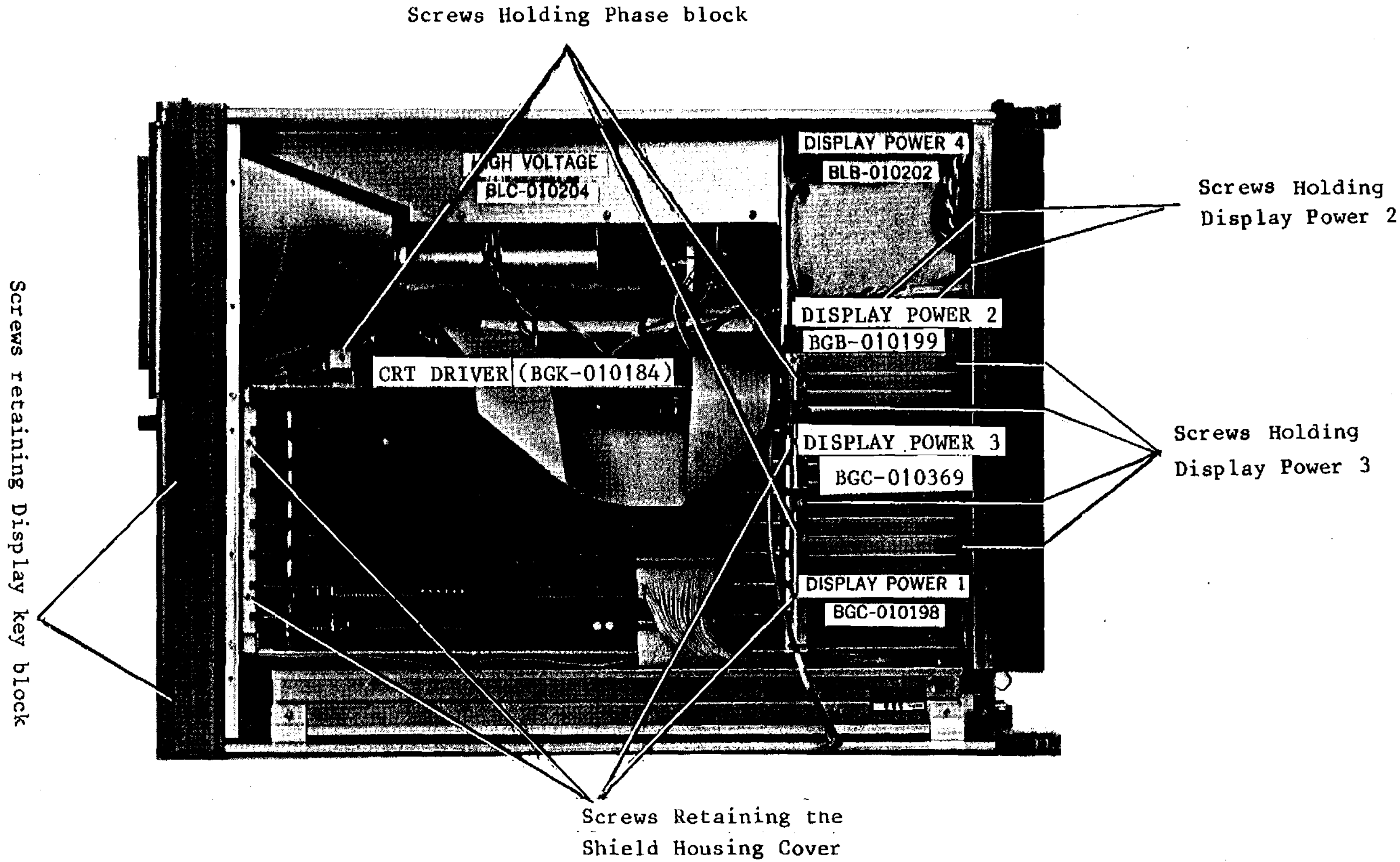


Fig. 13-1 Display section top view

(6) Boards within the shield housing

Disconnect the GP-IB and Key Control cables from the shield housing. Remove the four screws retaining the shield housing cover shown in Fig. 13-1, then remove the board holder from the pertinent board. After pulling out the pertinent board, remount it via the Extension Card as needed.

RAMP GENERATOR board	BGP-010185
ANALOG I/O board	BGP-010186
D-A CONVERTER board	BGP-010188
A-D CONVERTER board	BGP-010187
I/O & GP-IB board	BGP-010190
CPU board	BGP-010191
MEMORY board	BGP-010192
DISPLAY CONTROL board	BGP-010189

(7) MEP-338 (IF block) (See figures 13-1, 2, 4)

Remove the four retention screws shown in Figure 13-2, push the IF block forward until the input connector is completely pulled out of its mounting hole, then lift the block straight upward. When checking the IF-1 and IF-2 boards, remove their housing covers.

(8) MEP-339 (Phase block)

The phase block is accessible by removing the top cover. Remove the three retention screws shown in Figure 13-3 and the three retention screws shown in Figure 13-1.

(9) MEP-337 (Log block)

To access the Log block, remove the top cover by removing the top cover retention screws and IC heat sink retention screws, while referring to the assembly illustration. When removing the Log block, take off the three retention screws shown in Figure 13-3 and the two retention screws shown in Figure 13-4.

(10) MEP-354 (Display Key block)

When removing the Display key block, first remove the belt cover, then pull out the INTENSITY, VIDEO, and TRIGGER control knobs, and finally take off the four retention screws shown in Figures 13-1 and 13-4.

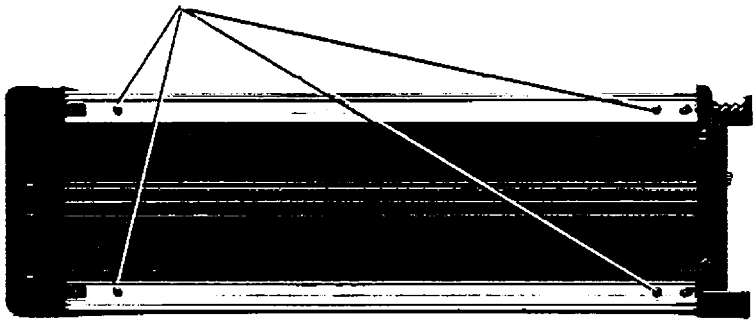


Fig. 13-2 Display section right side view

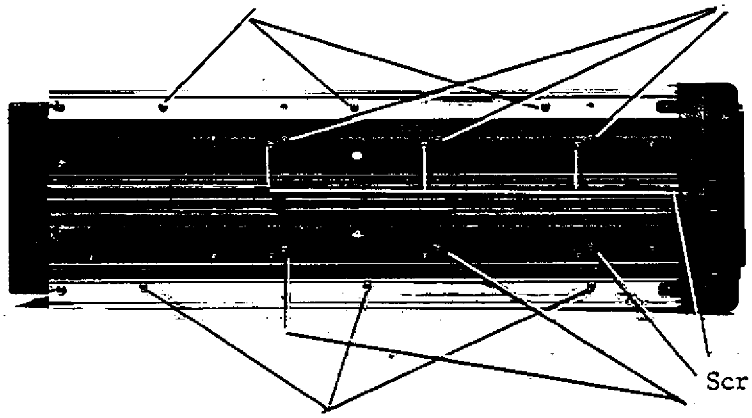


Fig. 13-3 Display section left side view

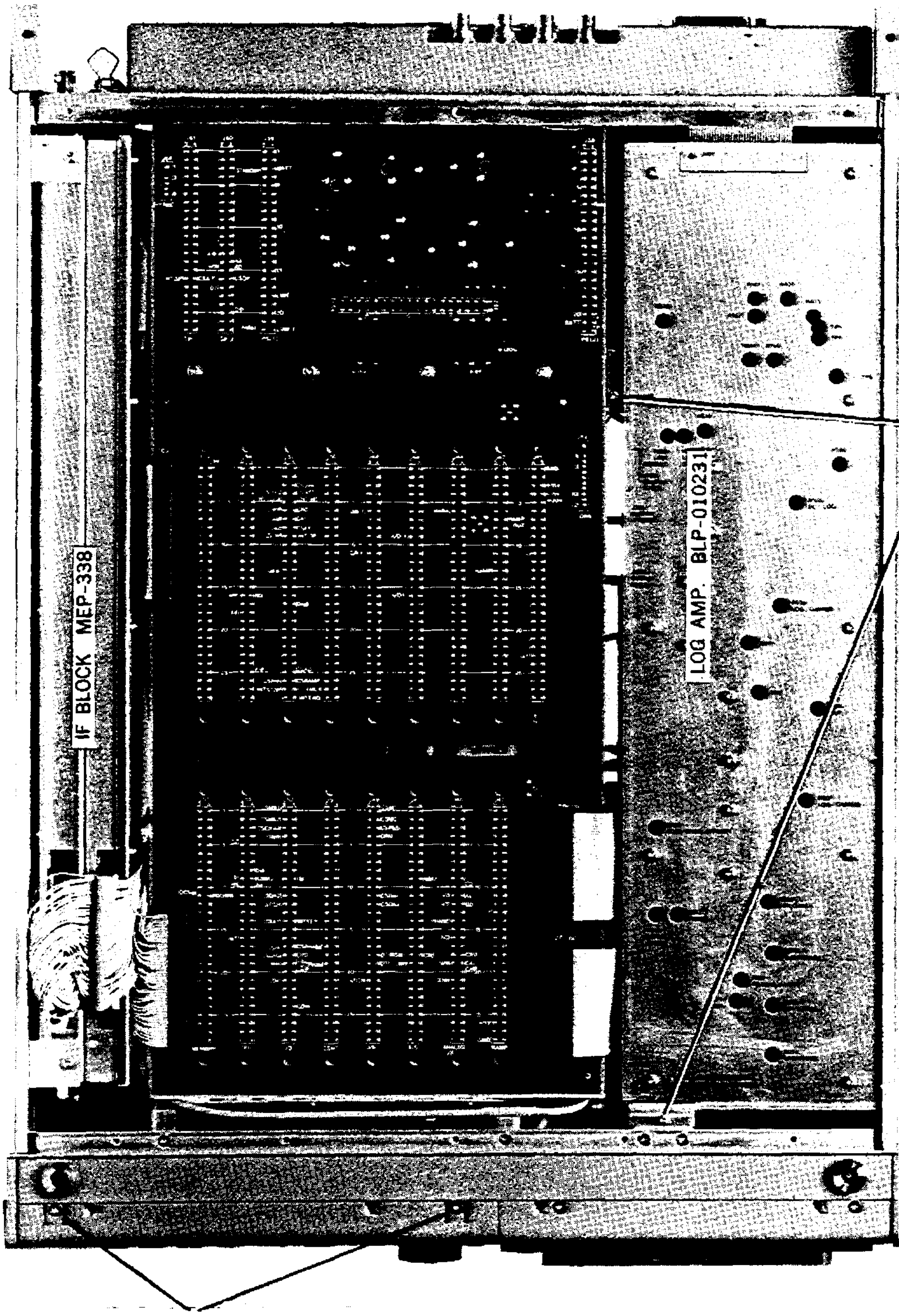


Fig. 13-4 TR4172 display section bottom view

(11) High Voltage Block (BLC-010204)

Remove the phase block as directed in step (8). Remove the rear foot and side plates from the Display Section referring to the assembly illustration, then remove the six screws retaining the high-voltage block cover shown in Figures 13-5 and 13-3. Next, remove the six board retention screws shown in Figure 13-3, then remove the board. Next, using the screw, connect the High voltage block to the mainframe as shown in Figure 13-6. When troubleshooting the high-voltage block, exercise caution to prevent electrical shock.

(12) CRT

More than 5 minutes after power is switched off, remove the high-voltage block cover as outlined in steps 8 and 11, pull out the anode cap from the CRT, then remove the CRT socket. Remove the CRT filter referring to the assembly illustration, then remove the four CRT retention screws shown in Figure 13-7 and push the CRT toward the front.

Screws retaining High Voltage block cover

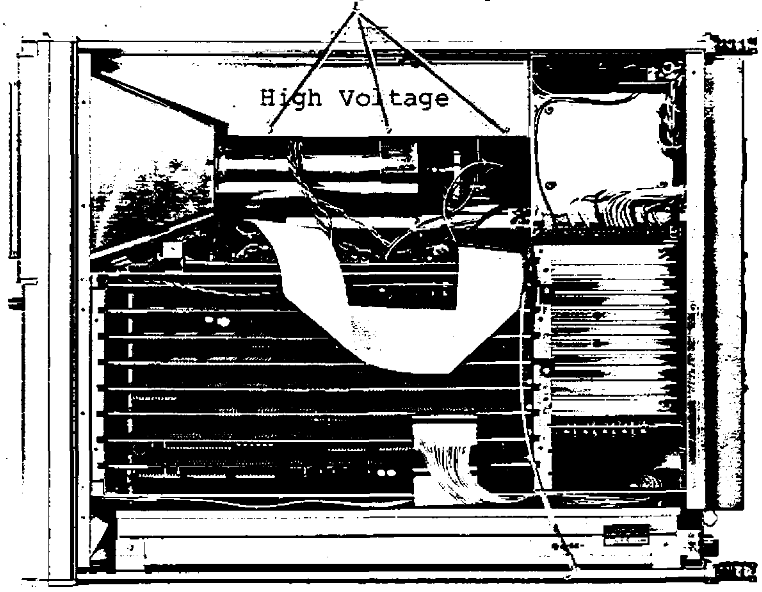


Fig. 13-5 High voltage

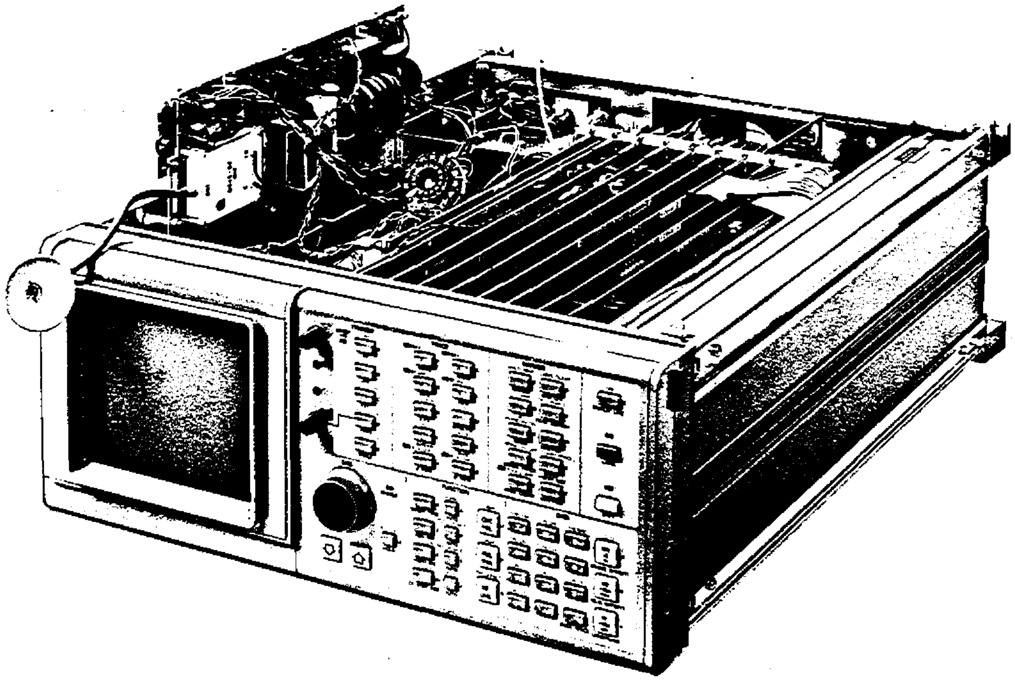


Fig. 13-6 High voltage re-mounting

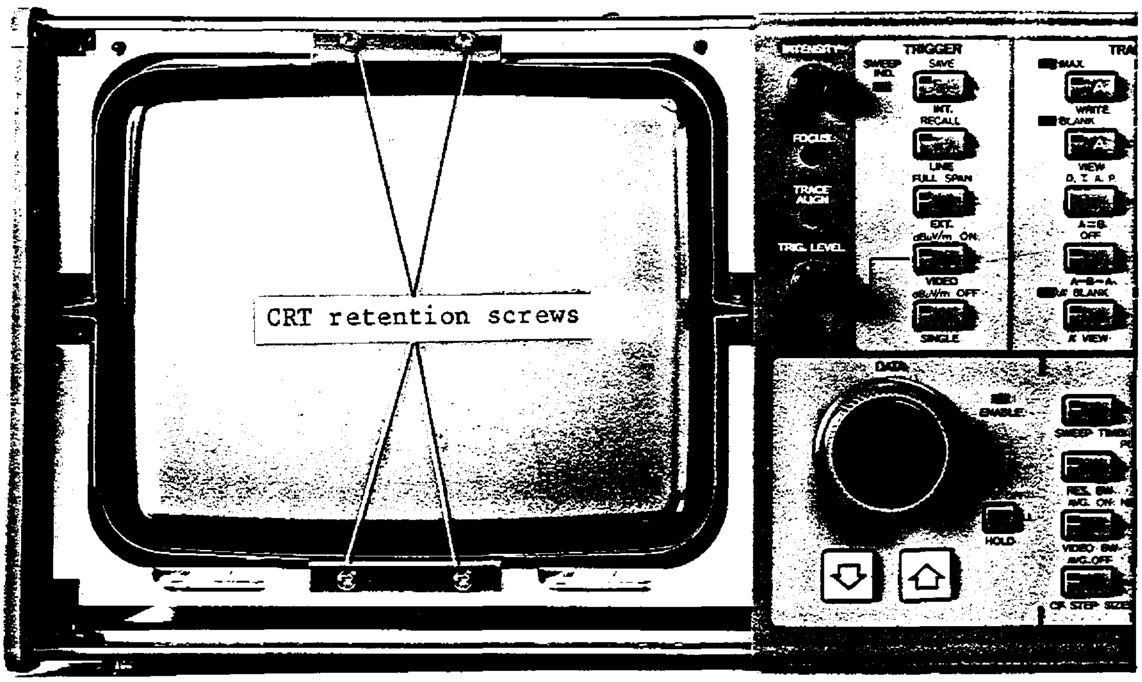


Fig. 13-7 CRT mounting screws

13-3-3. Removing the Boards and Blocks from the RF Section

(1) RF Power board (BLF-010370)

Pull out the power supply output cable from RF power board, then remove the five retention screws shown in Figure 14-11. Next, disconnect the connector plug (connected to the mother board) from side A of the board.

(2) Attenuator I/O (BGN-010220), YIG Oscillator I/O (BGN-010219), and 3rd LOCAL I/O (BGN-010221) boards

Remove the board holder (shown in Figure 13-8) by removing the two retention screws shown in Figure 13-9, then pull out the pertinent boards. Remount the boards in the same slot via the Extension Card as needed.

(3) MEP-340 (SUB-PANEL block)

Referring to the assembly illustration, remove the main panel together with the front subpanel. When checking the RF or TG attenuator, remove the SUB-PANEL block to enable access to these attenuator by removing the nine block retention screws, six of which are shown in Figures 13-9 and 13-10, while the remaining three are located on the bottom of the RF section . If RF or TG ATT is defective, replace the attenuators with normal unit.

(4) MEP-341 (YIG OSCILLATOR block)

After disconnecting all cables from the block, remove the five block retention screws. If the YIG OSC (DXY-000498), Coupler (RHB-000006), or POWER AMP (SNA-CGB204000-1) is defective, replace them with normal units.

(5) MEP-342 (STANDARD block)

When removing the STANDARD block, remove the four retention screws. For troubleshooting, remove the top cover from the block by removing the retention screws.

(6) MEP-343 (1st MIXER block)

When removing the 1st MIXER block, disconnect the power supply and all other cables from the block, then remove the two block retention screws. For troubleshooting, remove the top cover from the block shown in Figure 13-8. The 1st MIXER block can be separated from the Interface section by removing the four retention screws shown in Figure 13-11. If the Interface unit is found to be defective, it should be replaced with normal unit.

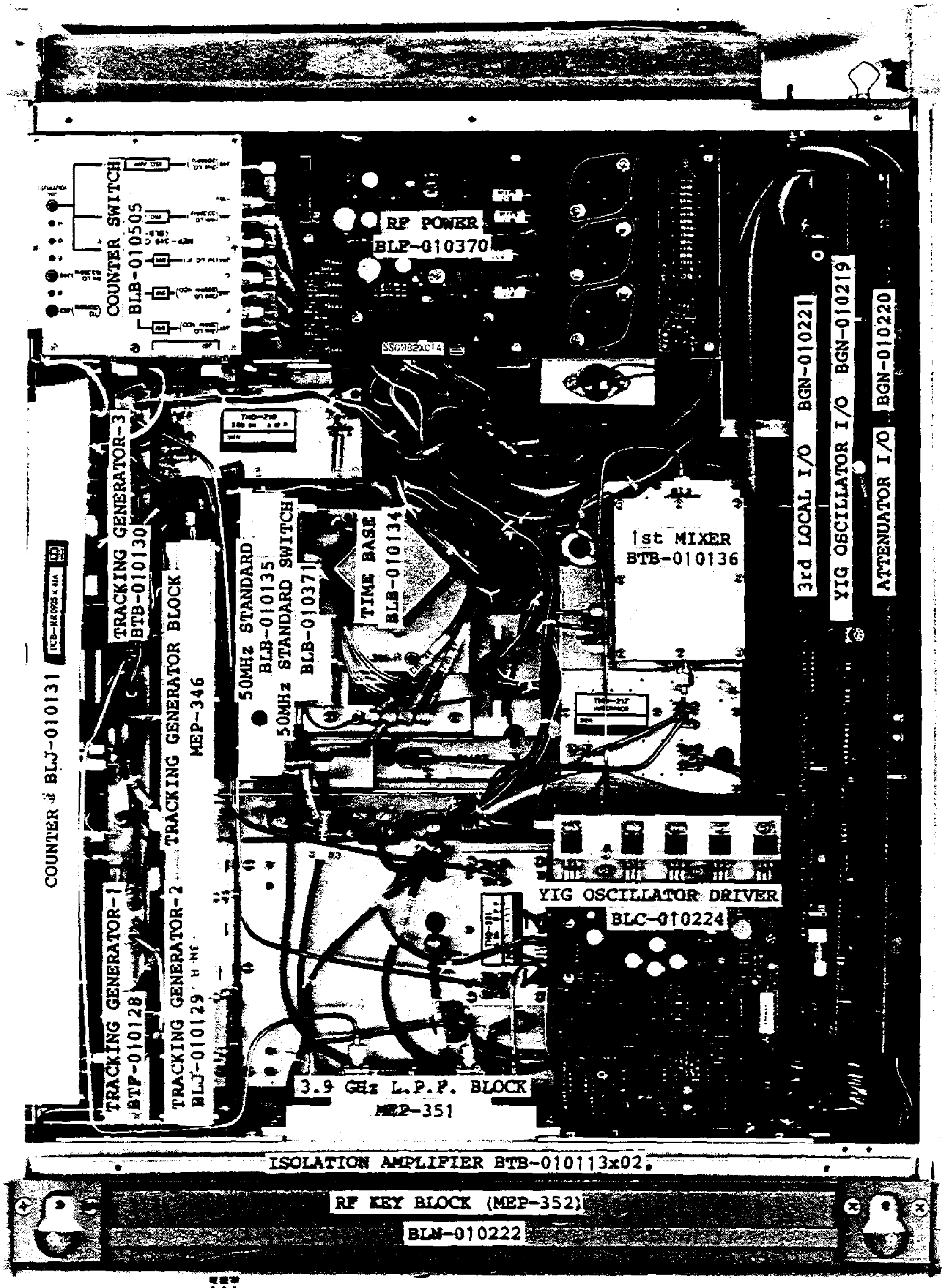


Fig. 13-8 RF Section Top View

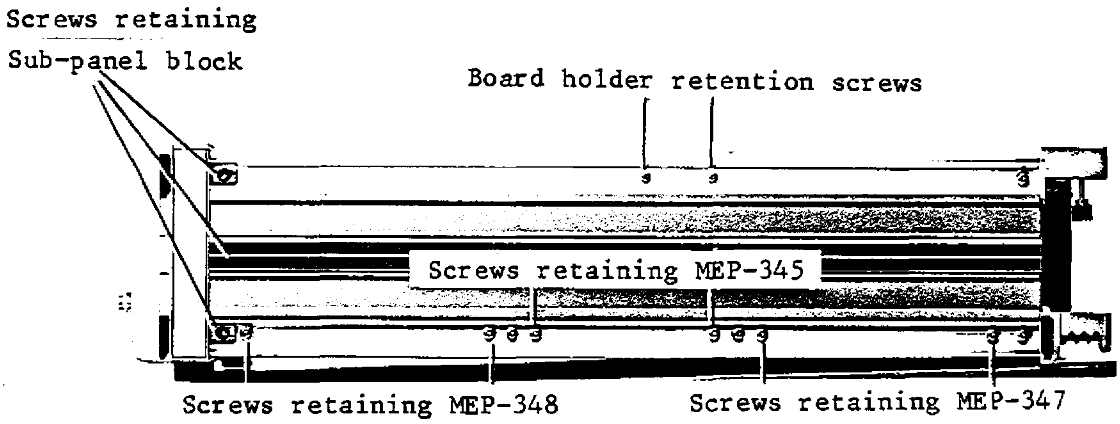


Fig. 13-9 RF section right side view

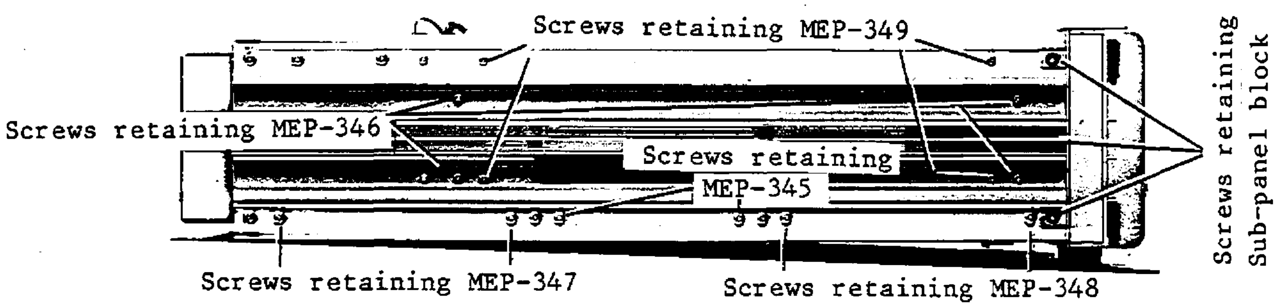


Fig. 13-10 RF section left side view

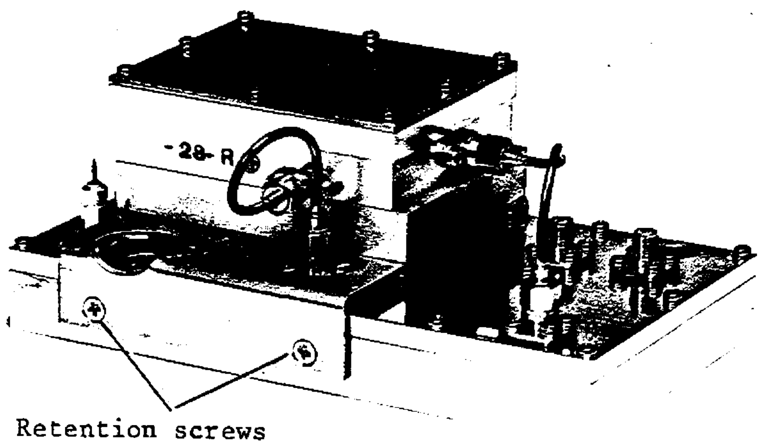


Fig. 13-11 Interface and 1st mixer

(7) MEP-345 (RF block), MEP-347 (3rd LOCAL block), and MEP-348 (1st LOCAL PLL block)

For troubleshooting, remove the top cover from each block, referring to the assembly illustrations. When removing the blocks, disconnect the power-supply, control, and signal cables from each block, then remove the four retention screws shown in Figures 13-9 and 13-10 from each block.

(8) MEP-346 (TRACKING GENERATOR block)

Referring to the assembly drawing, remove the two rear feet on the left and side plate, then remove the four retention screws shown in Figure 13-10. For troubleshooting, remove the top cover from the block and use each signal cable and interconnecting cable. If the 2.05 GHz AMP (SHB-000553) is defective, it should be replaced with a normal one.

(9) MEP-349 (COUNTER block)

As in step (8), remove the rear feet and side plate, then remove the retention screws shown in Figure 13-10.

CONTENTS OF TROUBLESHOOTING FLOWCHART

Page

CHART 1 Main Diagnostics Flowchart

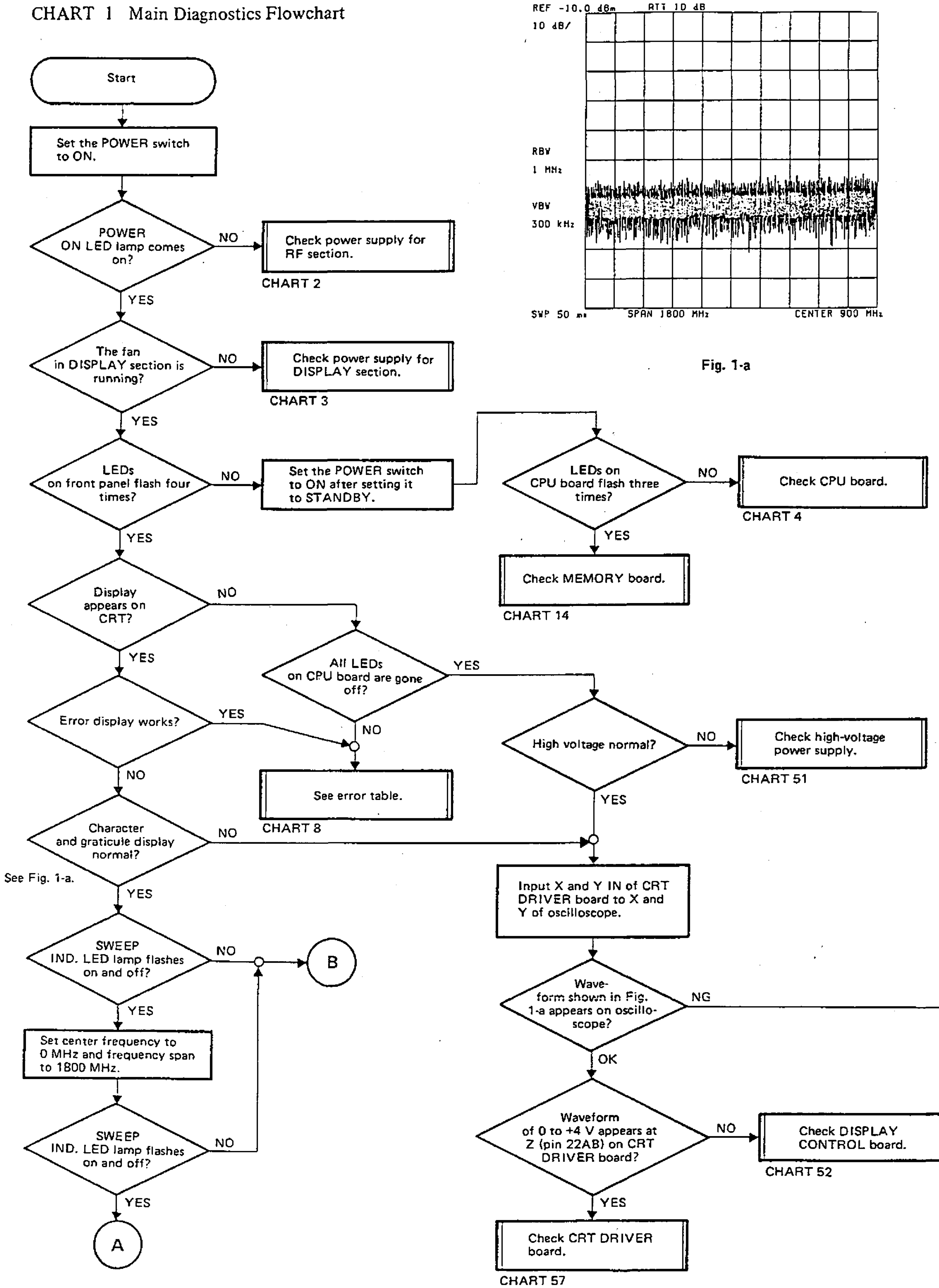
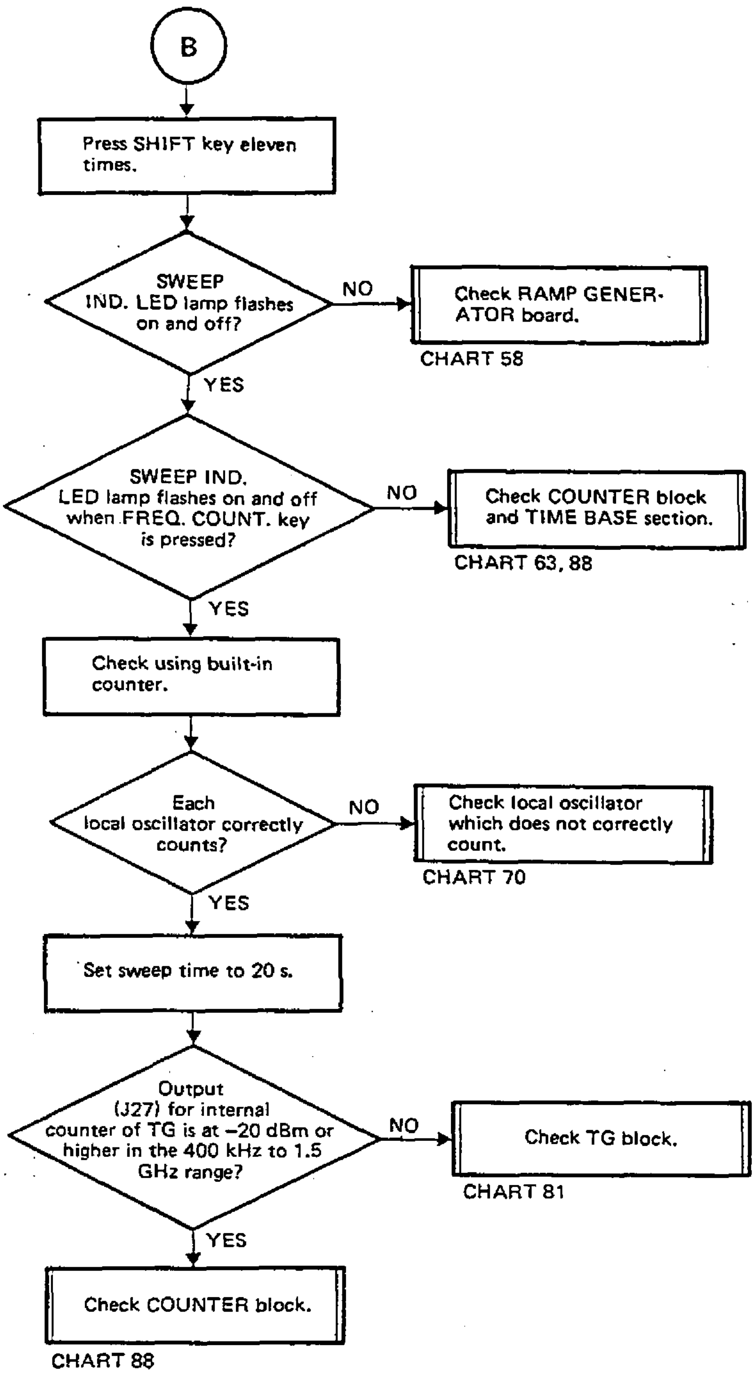
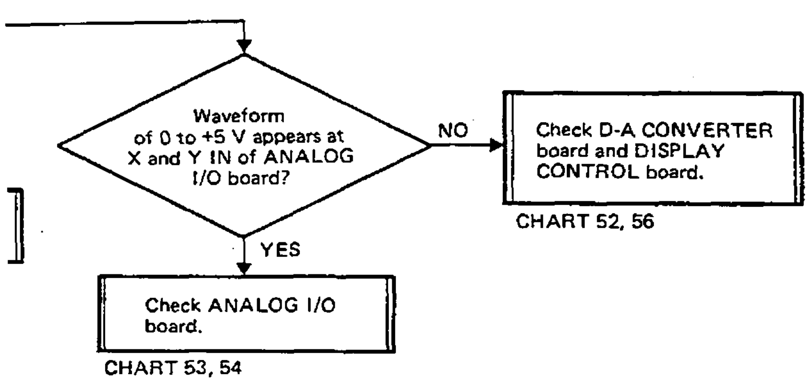


Fig. 1-a


B
Press SHIFT key eleven times.
SWEEP IND. LED lamp flashes on and off?
NO
Check RAMP GENERATOR board.
CHART 58
YES
SWEEP IND. LED lamp flashes on and off when FREQ. COUNT. key is pressed?
NO
Check COUNTER block and TIME BASE section.
CHART 63, 88
YES
Check using built-in counter.
Each local oscillator correctly counts?
NO
Check local oscillator which does not correctly count.
CHART 70
YES
Set sweep time to 20 s.
Output (J27) for internal counter of TG is at −20 dBm or higher in the 400 kHz to 1.5 GHz range?
NO
Check TG block.
CHART 81
YES
Check COUNTER block.
CHART 88


Waveform of 0 to +5 V appears at X and Y IN of ANALOG I/O board?
NO
Check D-A CONVERTER board and DISPLAY CONTROL board.
CHART 52, 56
YES
Check ANALOG I/O board.
CHART 53, 54

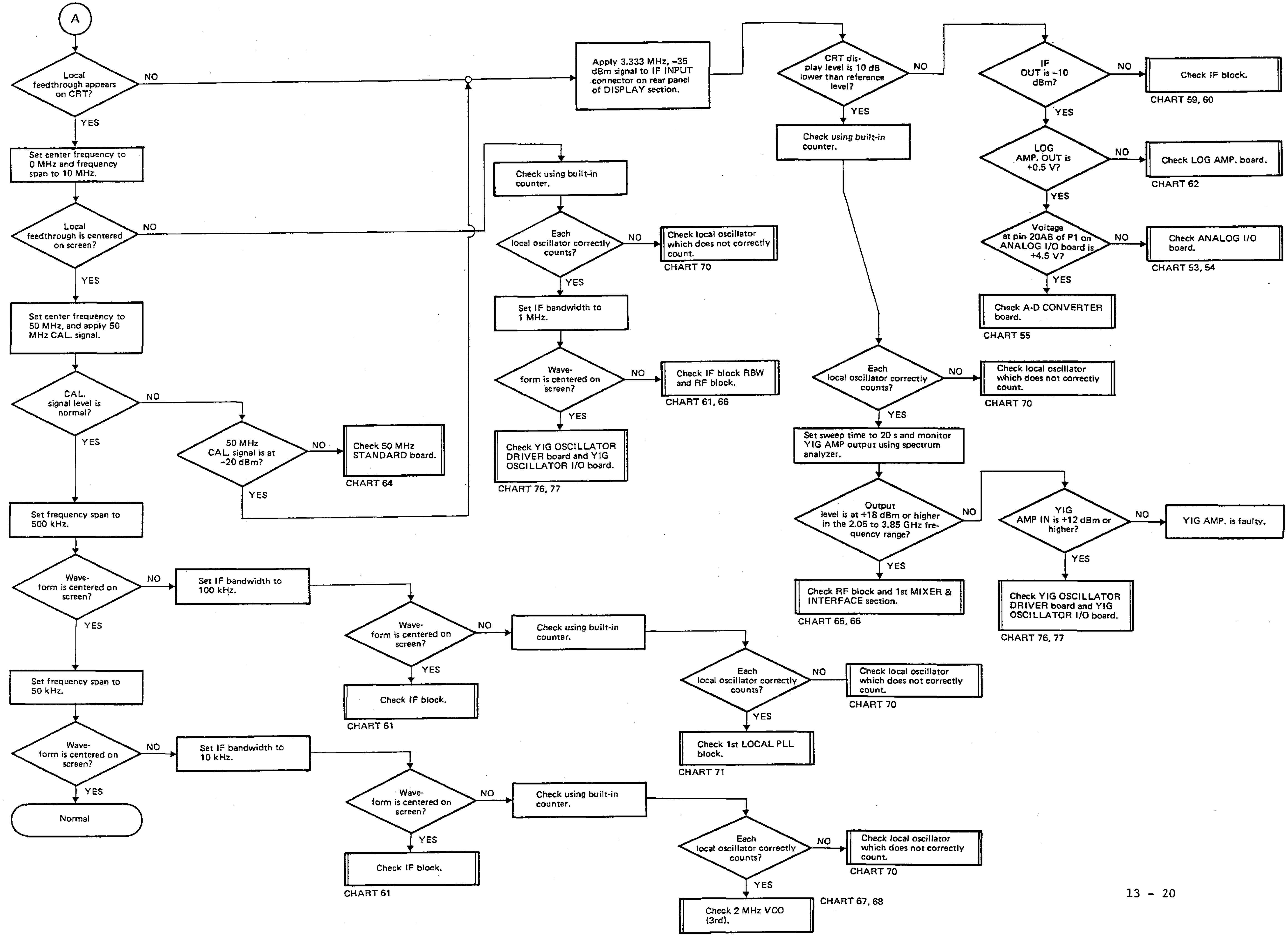
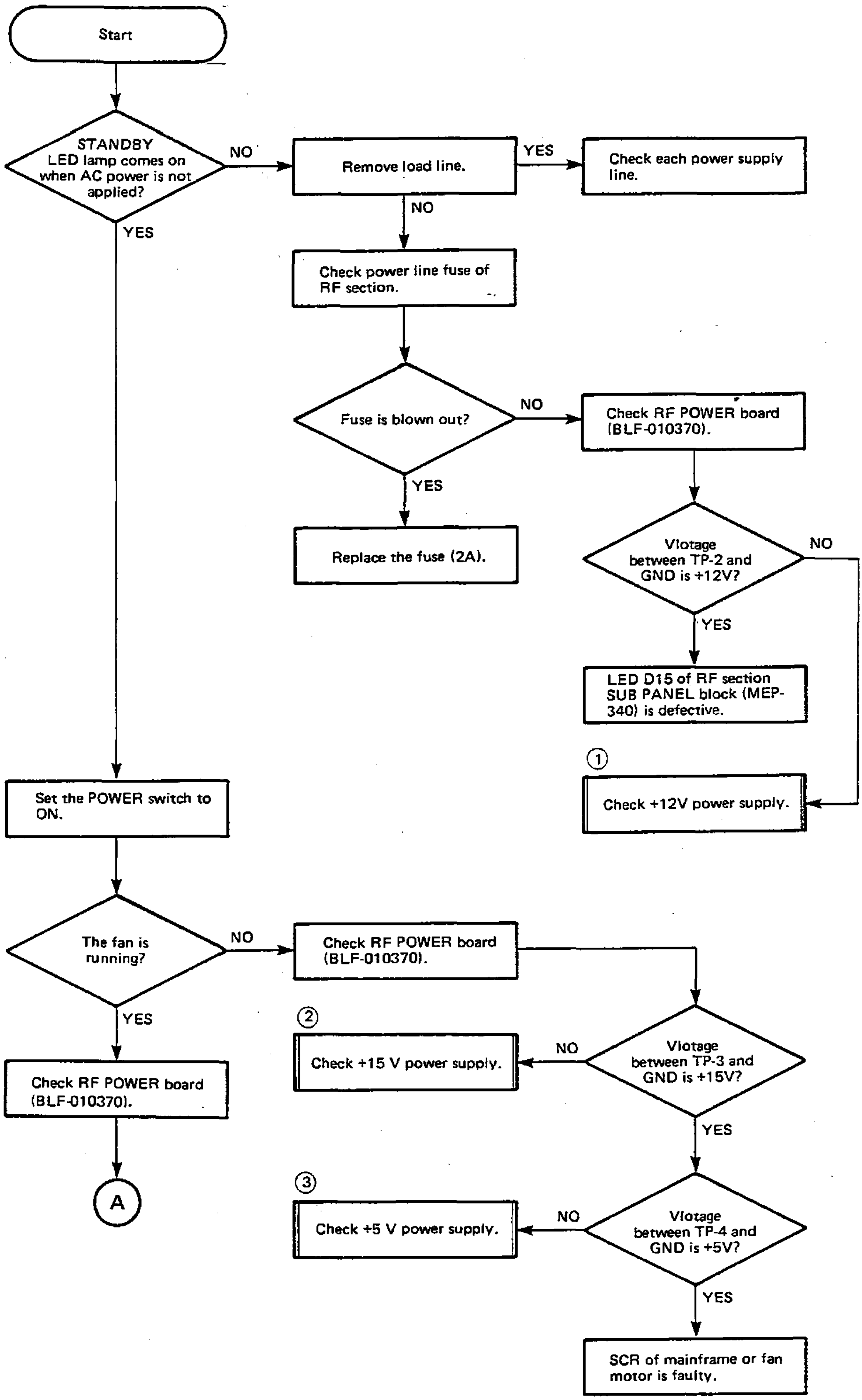
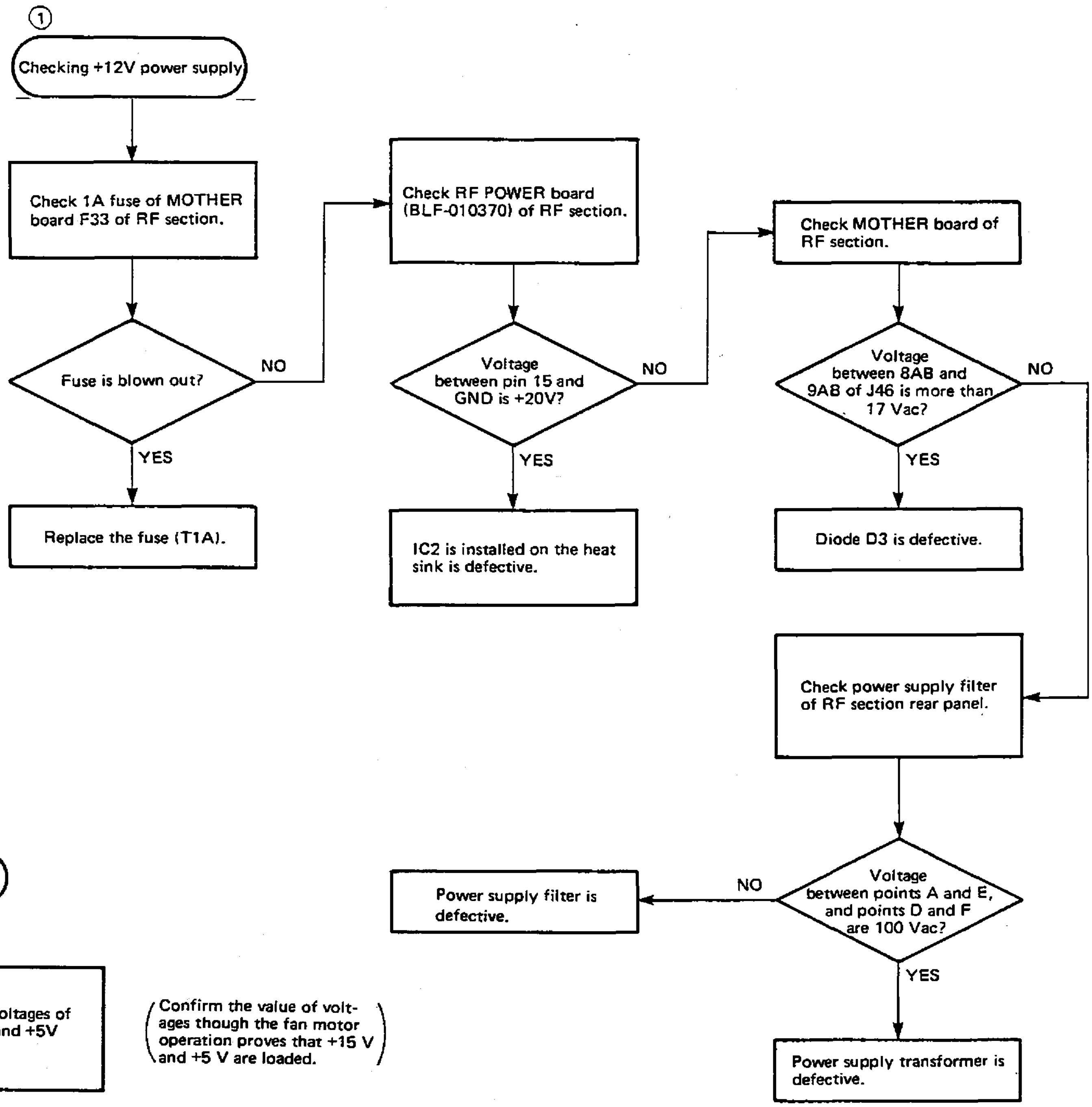

A
Local feedthrough appears on CRT?
NO
YES
Set center frequency to 0 MHz and frequency span to 10 MHz.
Local feedthrough is centered on screen?
Set center frequency to 50 MHz, and apply 50 MHz CAL. signal.
CAL. signal level is normal?
50 MHz CAL. signal is at −20 dBm?
Check 50 MHz STANDARD board.
CHART 64
Set frequency span to 500 kHz.
Wave-form is centered on screen?
Set IF bandwidth to 100 kHz.
Check using built-in counter.
Check IF block.
CHART 61
Set frequency span to 50 kHz.
Set IF bandwidth to 10 kHz.
Normal
Each local oscillator correctly counts?
Check local oscillator which does not correctly count.
CHART 70
Check 1st LOCAL PLL block.
CHART 71
Check 2 MHz VCO (3rd).
CHART 67, 68
Set IF bandwidth to 1 MHz.
Check IF block RBW and RF block.
CHART 61, 66
Check YIG OSCILLATOR DRIVER board and YIG OSCILLATOR I/O board.
CHART 76, 77
Apply 3.333 MHz, −35 dBm signal to IF INPUT connector on rear panel of DISPLAY section.
CRT display level is 10 dB lower than reference level?
IF OUT is −10 dBm?
Check IF block.
CHART 59, 60
LOG AMP. OUT is +0.5 V?
Check LOG AMP. board.
CHART 62
Voltage at pin 20AB of P1 on ANALOG I/O board is +4.5 V?
Check ANALOG I/O board.
CHART 53, 54
Check A-D CONVERTER board.
CHART 55
Set sweep time to 20 s and monitor YIG AMP output using spectrum analyzer.
Output level is at +18 dBm or higher in the 2.05 to 3.85 GHz frequency range?
Check RF block and 1st MIXER & INTERFACE section.
CHART 65, 66
YIG AMP IN is +12 dBm or higher?
YIG AMP. is faulty.

CHART 2 RF Section Power Supply





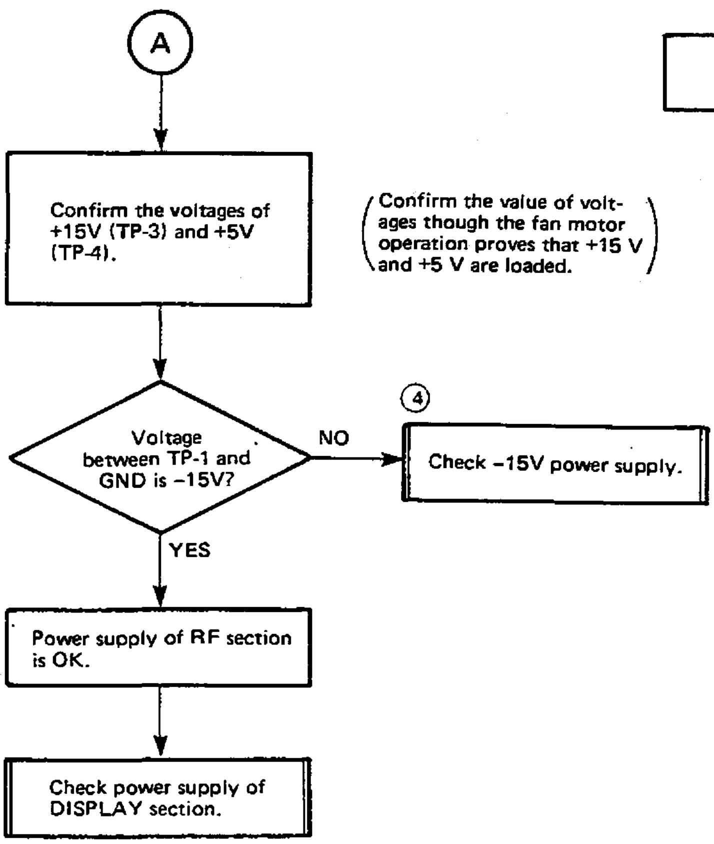
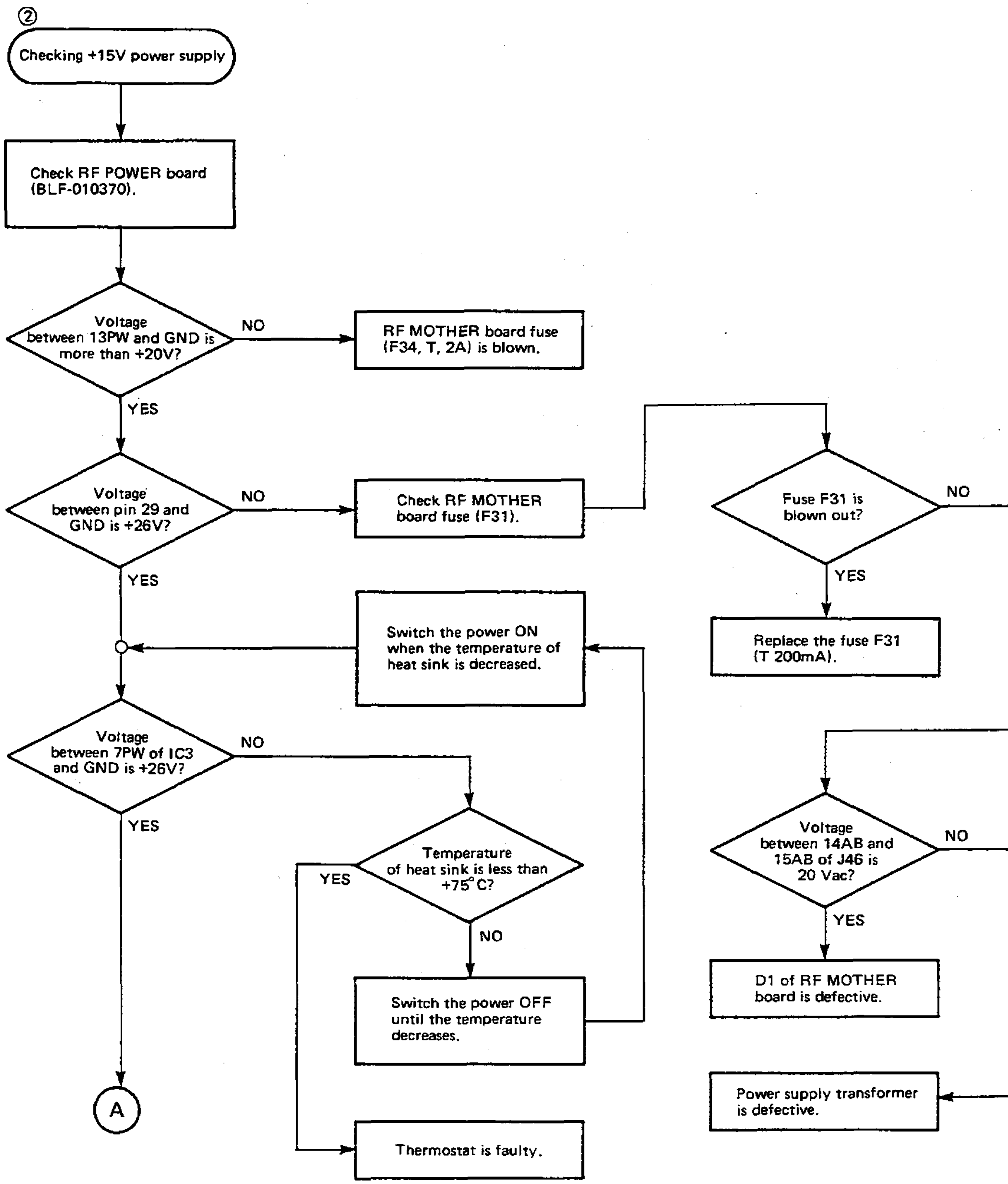
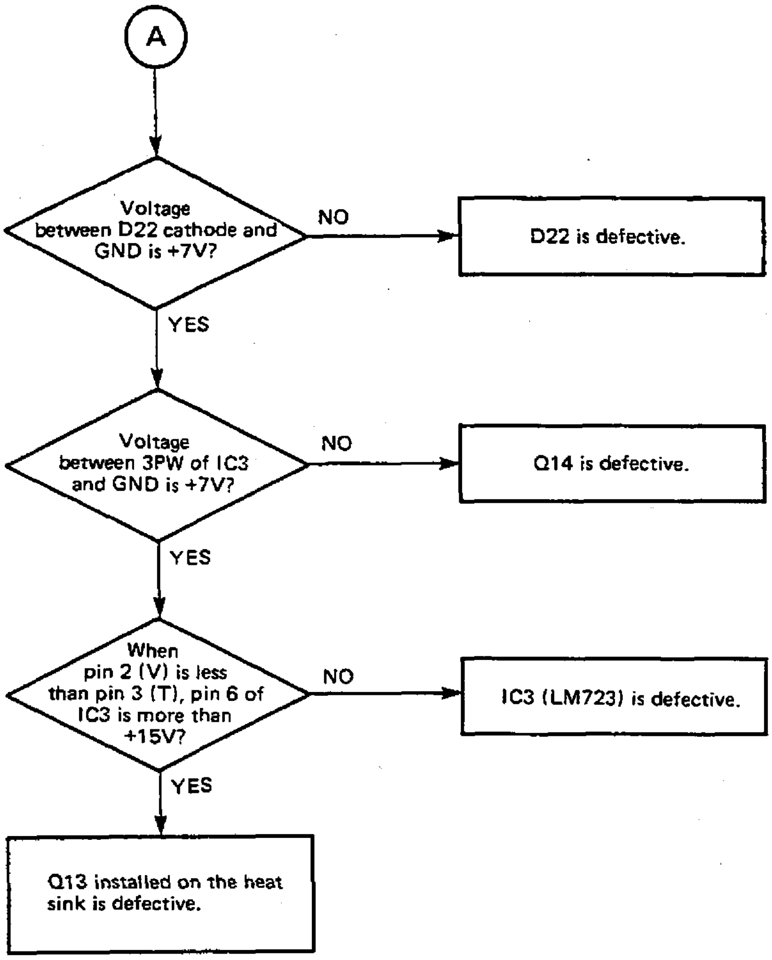


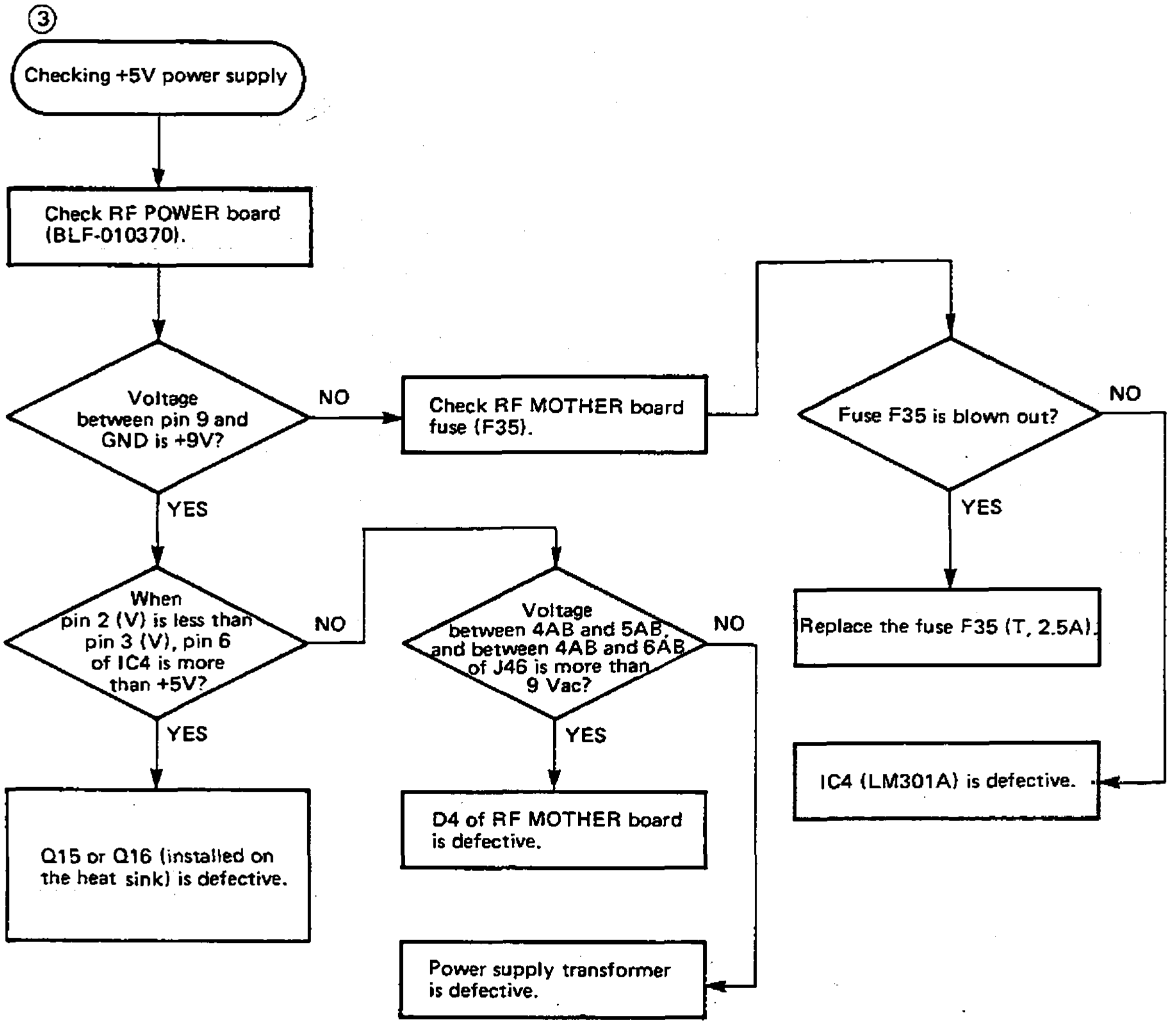
CHART 3

Table 2-a

No.	Power supply	Test point	Specification	VR to be adjusted
1	+12V	TP-2 ↔ GND	+12V±0.2V	No
2	+15V	TP-3 ↔ GND	+15V±0.7V	R139
3	+5V	TP-4 ↔ GND	+5V±0.5V	R47
4	−15V	TP-1 ↔ GND	−15V±1.5V	R133


②
Checking +15V power supply
Check RF POWER board (BLF-010370).
Voltage between 13PW and GND is more than +20V?
NO
RF MOTHER board fuse (F34, T, 2A) is blown.
YES
Voltage between pin 29 and GND is +26V?
NO
Check RF MOTHER board fuse (F31).
Fuse F31 is blown out?
NO
YES
Replace the fuse F31 (T 200mA).
YES
Switch the power ON when the temperature of heat sink is decreased.
Voltage between 7PW of IC3 and GND is +26V?
NO
YES
Temperature of heat sink is less than +75° C?
YES
NO
Switch the power OFF until the temperature decreases.
Voltage between 14AB and 15AB of J46 is 20 Vac?
NO
YES
D1 of RF MOTHER board is defective.
Power supply transformer is defective.
A
Thermostat is faulty.


A
Voltage between D22 cathode and GND is +7V?
NO
D22 is defective.
YES
Voltage between 3PW of IC3 and GND is +7V?
NO
Q14 is defective.
YES
When pin 2 (V) is less than pin 3 (T), pin 6 of IC3 is more than +15V?
NO
IC3 (LM723) is defective.
YES
Q13 installed on the heat sink is defective.


③
Checking +5V power supply
Check RF POWER board (BLF-010370).
Voltage between pin 9 and GND is +9V?
NO
Check RF MOTHER board fuse (F35).
Fuse F35 is blown out?
NO
YES
Replace the fuse F35 (T, 2.5A).
IC4 (LM301A) is defective.
YES
When pin 2 (V) is less than pin 3 (V), pin 6 of IC4 is more than +5V?
NO
Voltage between 4AB and 5AB, and between 4AB and 6AB of J46 is more than 9 Vac?
NO
YES
D4 of RF MOTHER board is defective.
Power supply transformer is defective.
YES
Q15 or Q16 (installed on the heat sink) is defective.

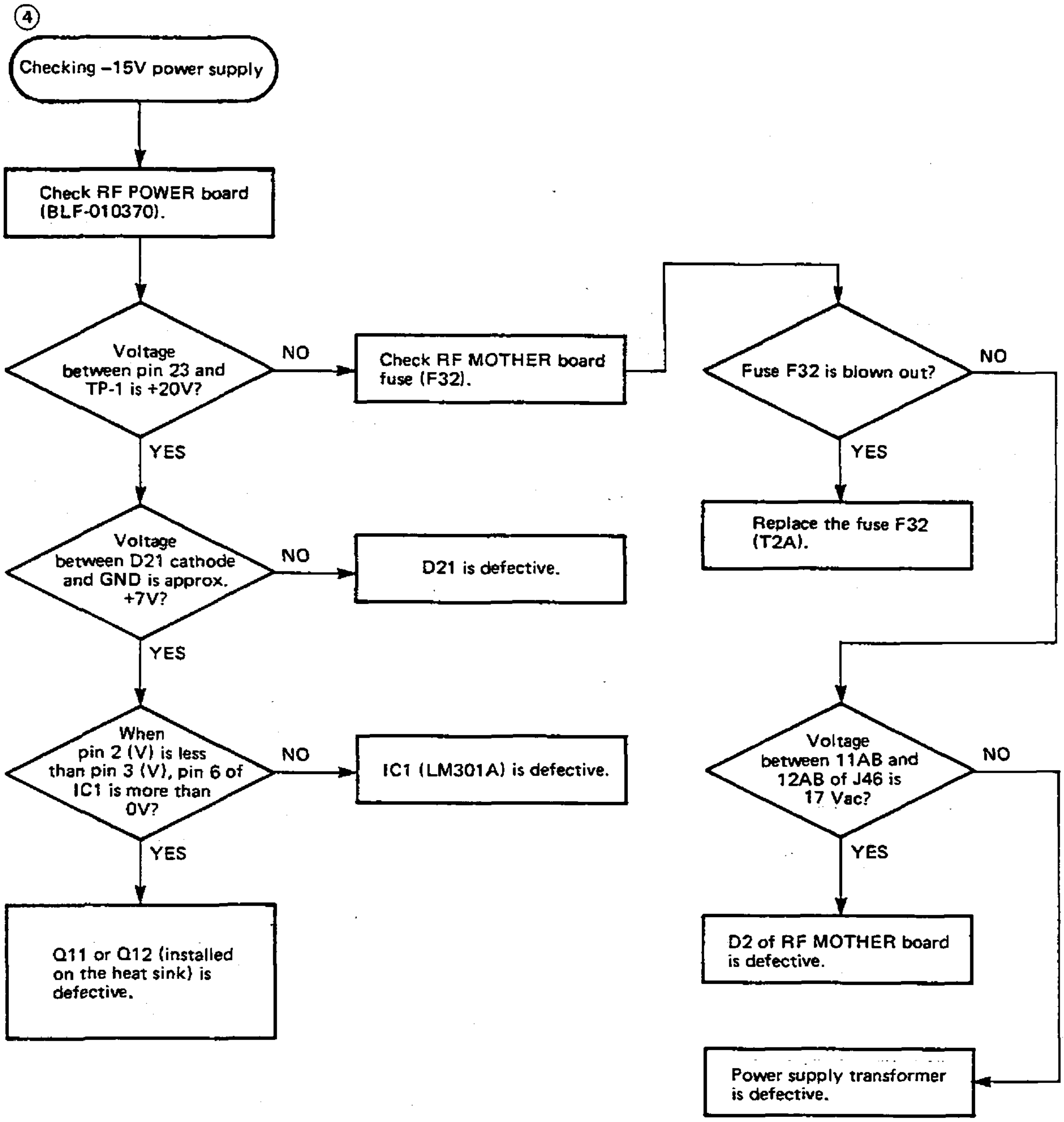

4
Checking −15V power supply
Check RF POWER board (BLF-010370).
Voltage between pin 23 and TP-1 is +20V?
NO
Check RF MOTHER board fuse (F32).
Fuse F32 is blown out?
NO
YES
Replace the fuse F32 (T2A).
YES
Voltage between D21 cathode and GND is approx. +7V?
NO
D21 is defective.
YES
When pin 2 (V) is less than pin 3 (V), pin 6 of IC1 is more than 0V?
NO
IC1 (LM301A) is defective.
YES
Q11 or Q12 (installed on the heat sink) is defective.
Voltage between 11AB and 12AB of J46 is 17 Vac?
NO
YES
D2 of RF MOTHER board is defective.
Power supply transformer is defective.

CHART 3 DISPLAY Section Power Supply

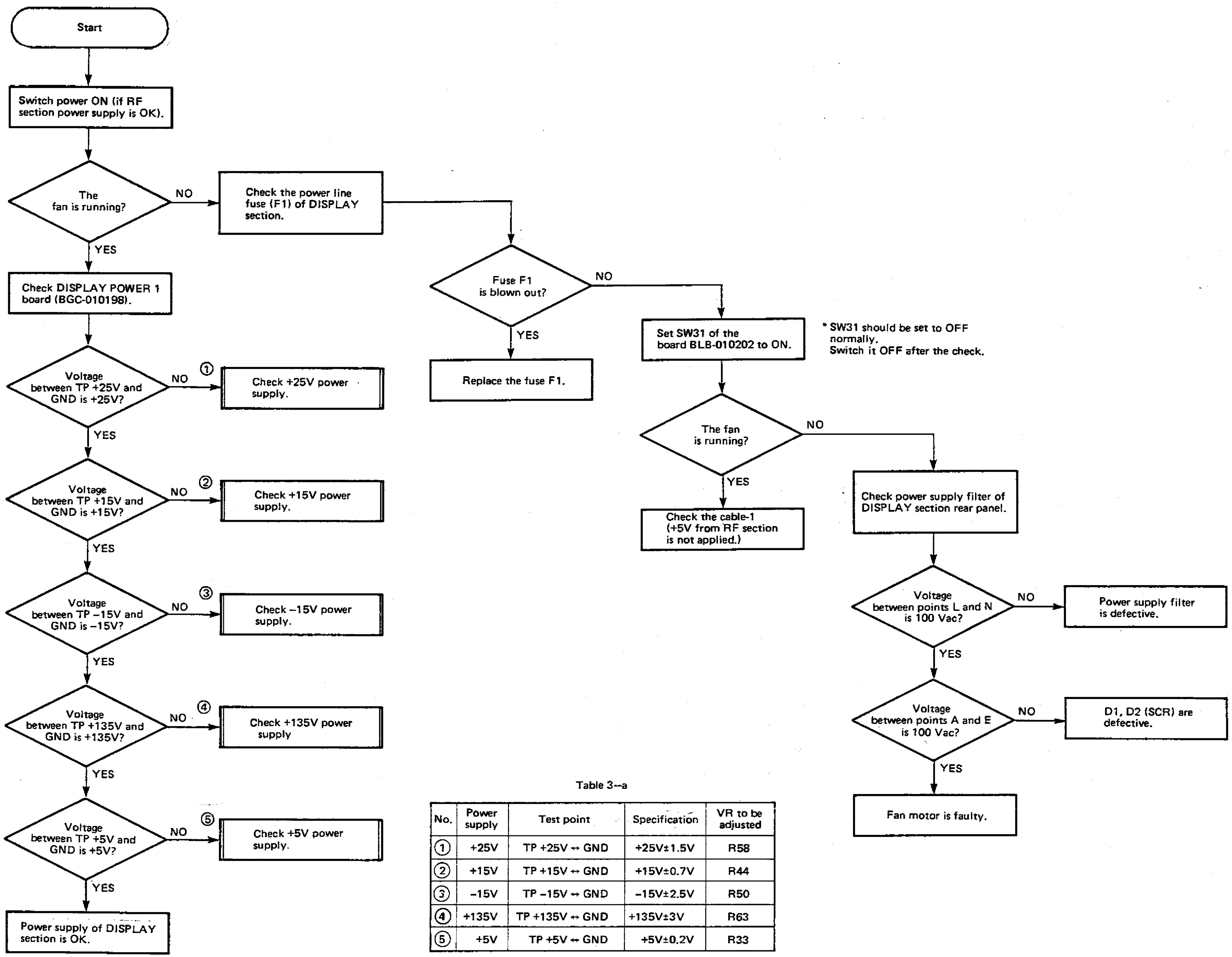
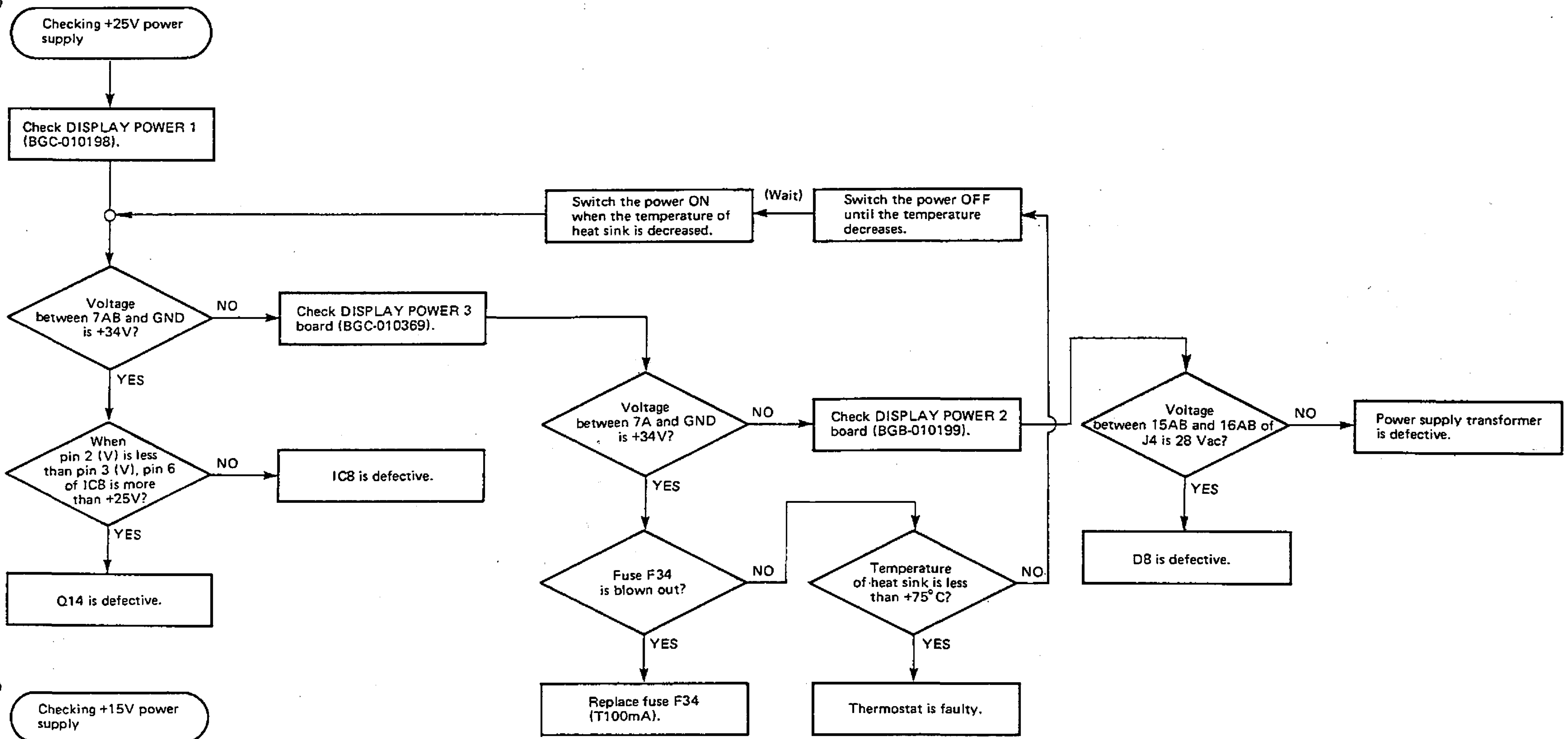


Table 3–a

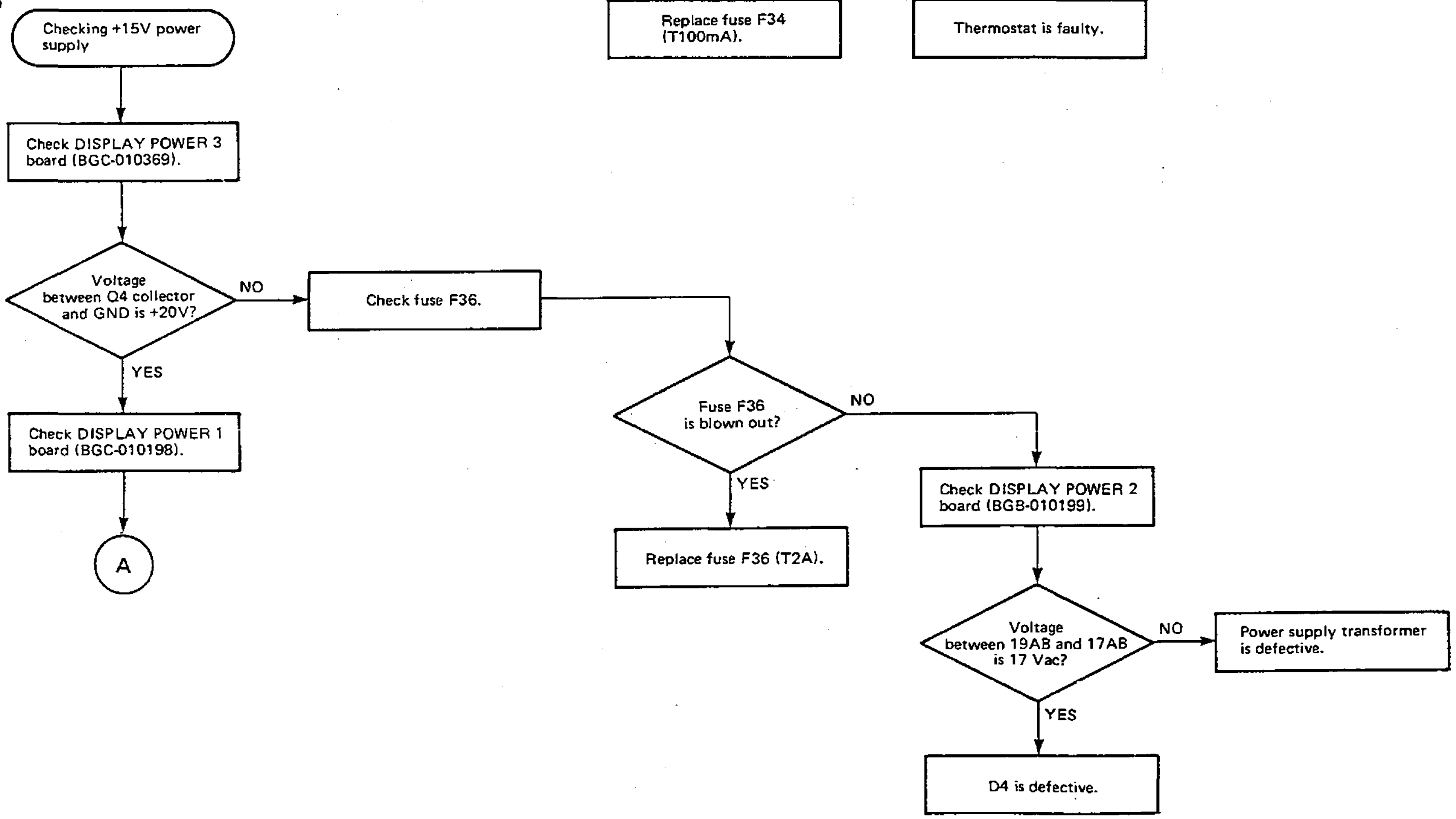
No.	Power supply	Test point	Specification	VR to be adjusted
①	+25V	TP +25V ↔ GND	+25V±1.5V	R58
②	+15V	TP +15V ↔ GND	+15V±0.7V	R44
③	−15V	TP −15V ↔ GND	−15V±2.5V	R50
④	+135V	TP +135V ↔ GND	+135V±3V	R63
⑤	+5V	TP +5V ↔ GND	+5V±0.2V	R33

①

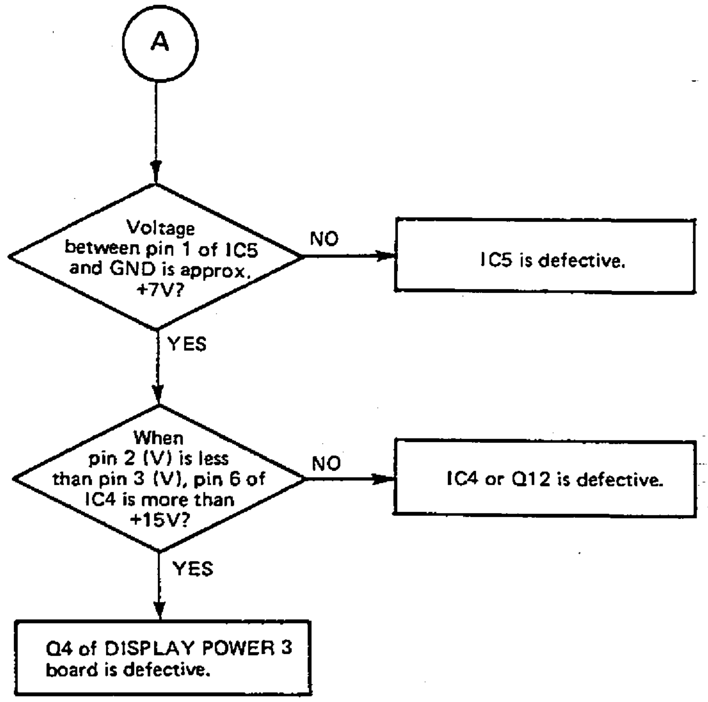


Checking +25V power supply
Check DISPLAY POWER 1 (BGC-010198).
Switch the power ON when the temperature of heat sink is decreased.
(Wait)
Switch the power OFF until the temperature decreases.
Voltage between 7AB and GND is +34V?
NO
Check DISPLAY POWER 3 board (BGC-010369).
YES
Voltage between 7A and GND is +34V?
NO
Check DISPLAY POWER 2 board (BGB-010199).
Voltage between 15AB and 16AB of J4 is 28 Vac?
NO
Power supply transformer is defective.
When pin 2 (V) is less than pin 3 (V), pin 6 of IC8 is more than +25V?
NO
IC8 is defective.
YES
YES
YES
D8 is defective.
Q14 is defective.
Fuse F34 is blown out?
NO
Temperature of heat sink is less than +75° C?
NO
YES
YES
Replace fuse F34 (T100mA).
Thermostat is faulty.

②

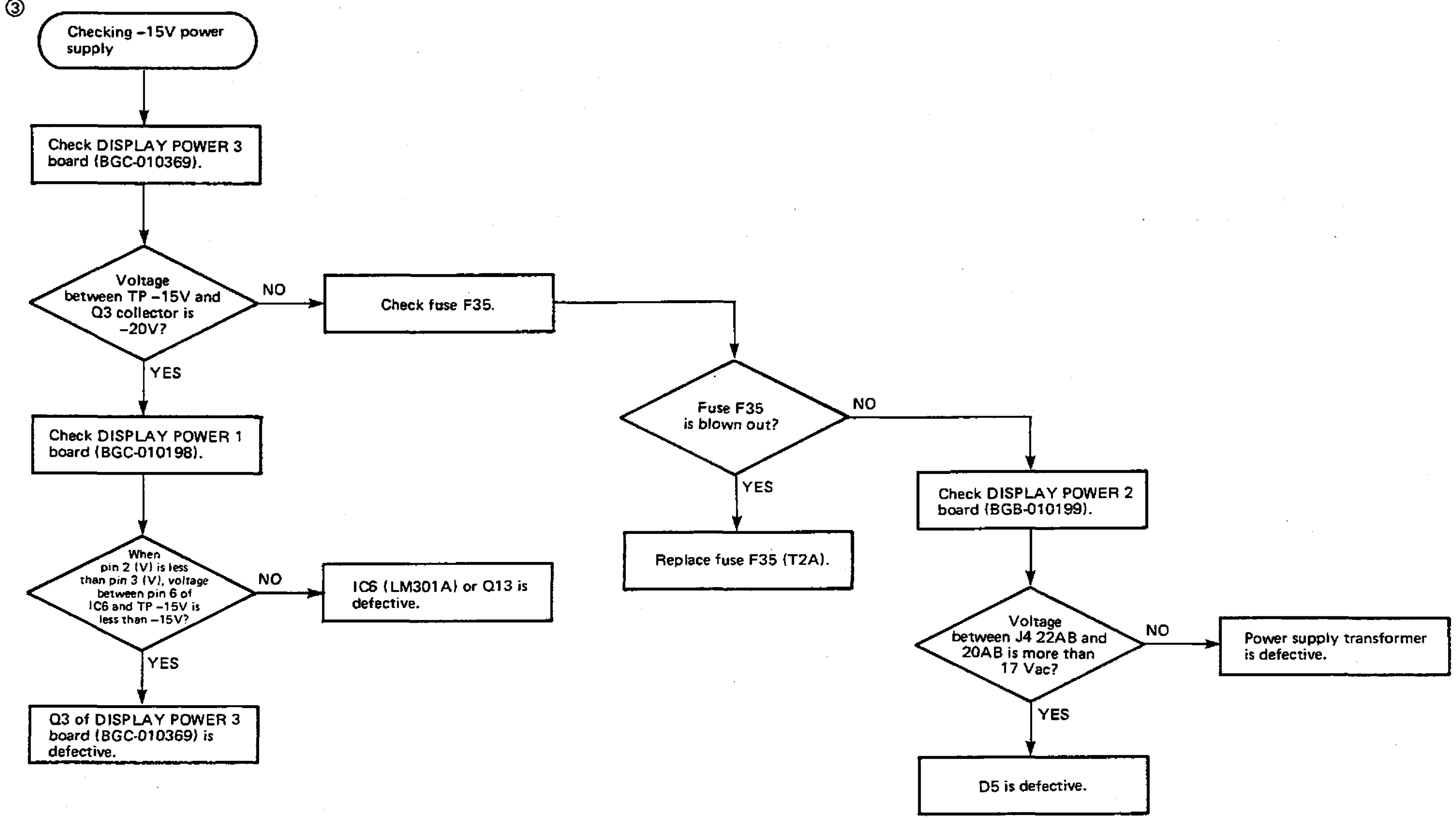


Checking +15V power supply
Check DISPLAY POWER 3 board (BGC-010369).
Voltage between Q4 collector and GND is +20V?
NO
Check fuse F36.
YES
Check DISPLAY POWER 1 board (BGC-010198).
A
Fuse F36 is blown out?
NO
YES
Replace fuse F36 (T2A).
Check DISPLAY POWER 2 board (BGB-010199).
Voltage between 19AB and 17AB is 17 Vac?
NO
Power supply transformer is defective.
YES
D4 is defective.



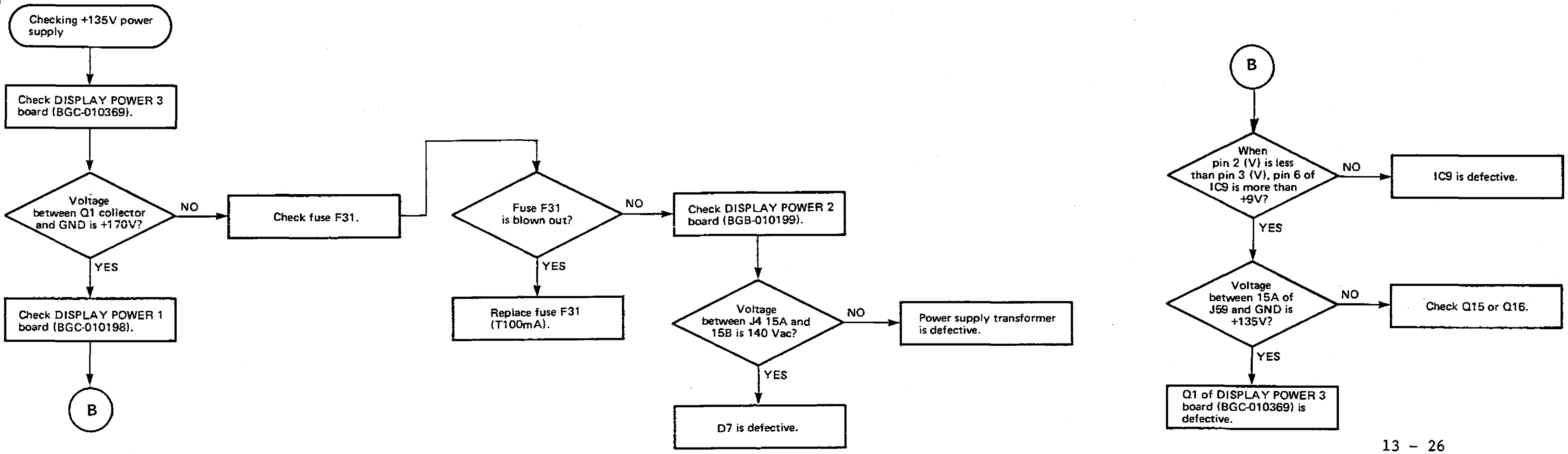
A
Voltage between pin 1 of IC5 and GND is approx. +7V?
NO
IC5 is defective.
YES
When pin 2 (V) is less than pin 3 (V), pin 6 of IC4 is more than +15V?
NO
IC4 or Q12 is defective.
YES
Q4 of DISPLAY POWER 3 board is defective.

③



Checking -15V power supply
Check DISPLAY POWER 3 board (BGC-010369).
Voltage between TP -15V and Q3 collector is -20V?
NO
YES
Check fuse F35.
Fuse F35 is blown out?
NO
YES
Replace fuse F35 (T2A).
Check DISPLAY POWER 2 board (BGB-010199).
Voltage between J4 22AB and 20AB is more than 17 Vac?
NO
Power supply transformer is defective.
YES
D5 is defective.
Check DISPLAY POWER 1 board (BGC-010198).
When pin 2 (V) is less than pin 3 (V), voltage between pin 6 of IC6 and TP -15V is less than -15V?
NO
IC6 (LM301A) or Q13 is defective.
YES
Q3 of DISPLAY POWER 3 board (BGC-010369) is defective.

④



Checking +135V power supply
Check DISPLAY POWER 3 board (BGC-010369).
Voltage between Q1 collector and GND is +170V?
NO
Check fuse F31.
Fuse F31 is blown out?
NO
Check DISPLAY POWER 2 board (BGB-010199).
Voltage between J4 15A and 15B is 140 Vac?
NO
Power supply transformer is defective.
YES
D7 is defective.
YES
Replace fuse F31 (T100mA).
YES
Check DISPLAY POWER 1 board (BGC-010198).
B
B
When pin 2 (V) is less than pin 3 (V), pin 6 of IC9 is more than +9V?
NO
IC9 is defective.
YES
Voltage between 15A of J59 and GND is +135V?
NO
Check Q15 or Q16.
YES
Q1 of DISPLAY POWER 3 board (BGC-010369) is defective.

⑤

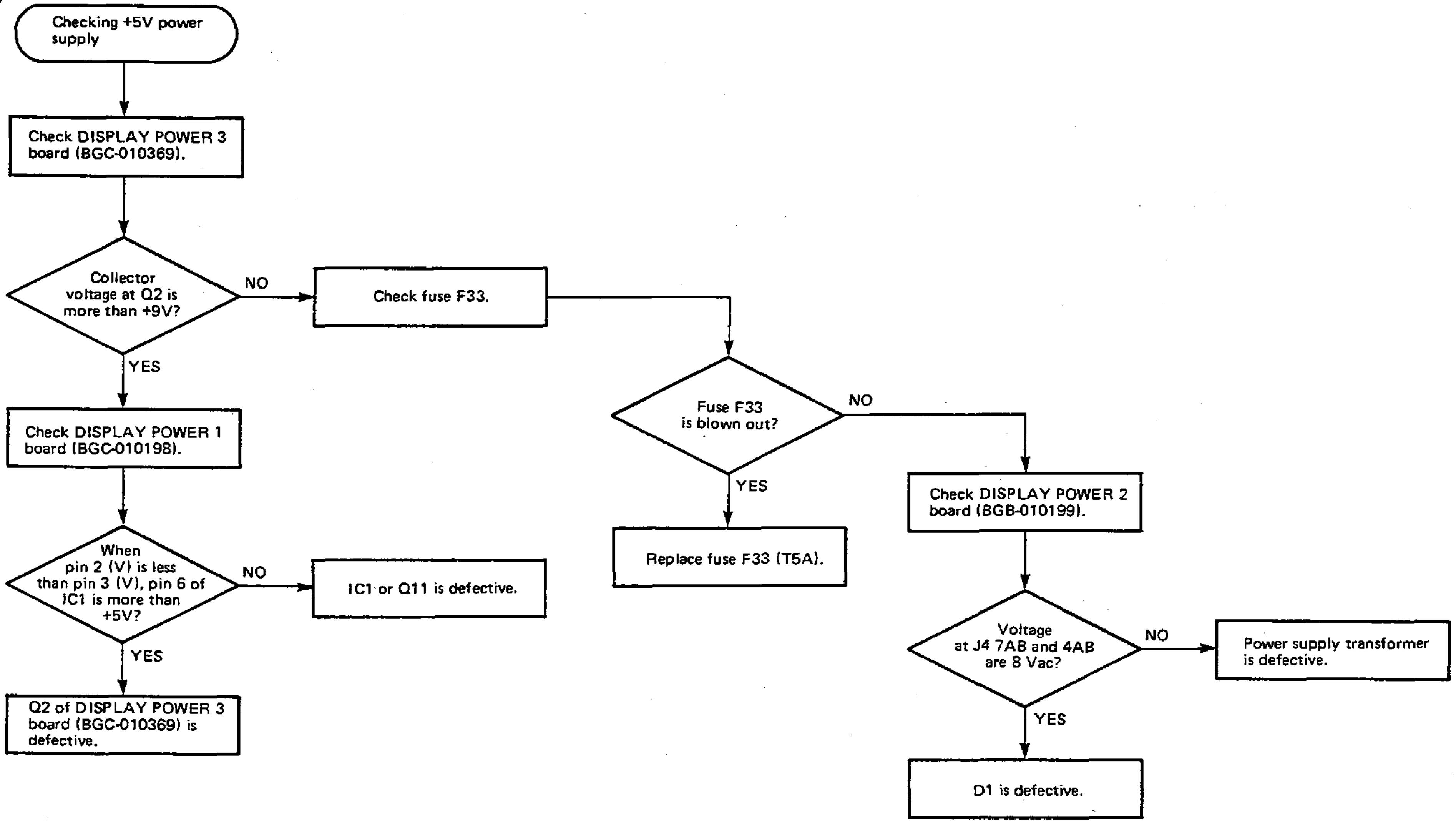
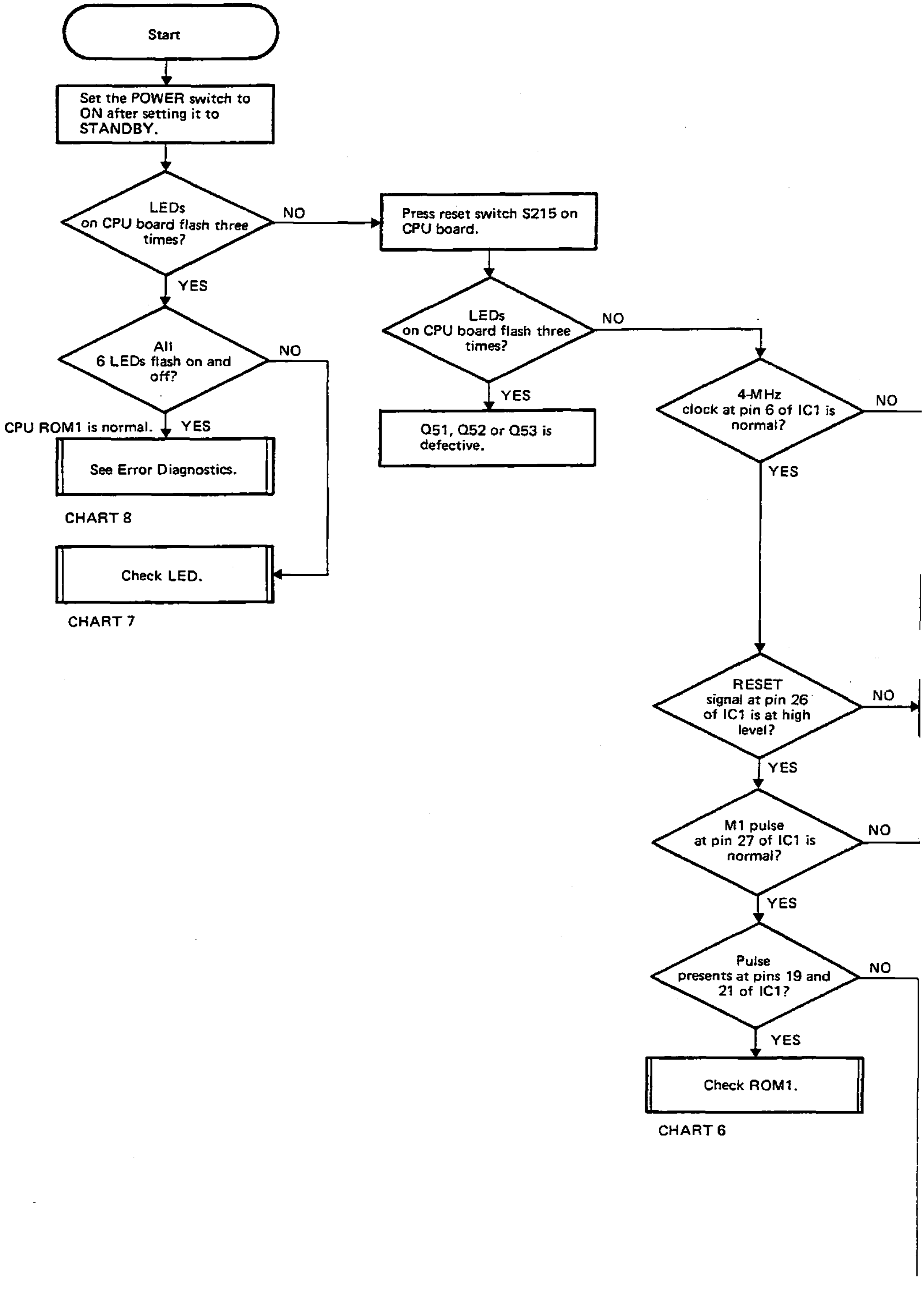

Checking +5V power supply
Check DISPLAY POWER 3 board (BGC-010369).
Collector voltage at Q2 is more than +9V?
NO
Check fuse F33.
YES
Check DISPLAY POWER 1 board (BGC-010198).
When pin 2 (V) is less than pin 3 (V), pin 6 of IC1 is more than +5V?
NO
IC1 or Q11 is defective.
YES
Q2 of DISPLAY POWER 3 board (BGC-010369) is defective.
Fuse F33 is blown out?
NO
YES
Replace fuse F33 (T5A).
Check DISPLAY POWER 2 board (BGB-010199).
Voltage at J4 7AB and 4AB are 8 Vac?
NO
Power supply transformer is defective.
YES
D1 is defective.

CHART 4 CPU


Start
Set the POWER switch to ON after setting it to STANDBY.
LEDs on CPU board flash three times?
NO
Press reset switch S215 on CPU board.
YES
All 6 LEDs flash on and off?
NO
LEDs on CPU board flash three times?
NO
YES
CPU ROM1 is normal.
YES
See Error Diagnostics.
CHART 8
Q51, Q52 or Q53 is defective.
4-MHz clock at pin 6 of IC1 is normal?
NO
YES
Check LED.
CHART 7
RESET signal at pin 26 of IC1 is at high level?
NO
YES
M1 pulse at pin 27 of IC1 is normal?
NO
YES
Pulse presents at pins 19 and 21 of IC1?
NO
YES
Check ROM1.
CHART 6

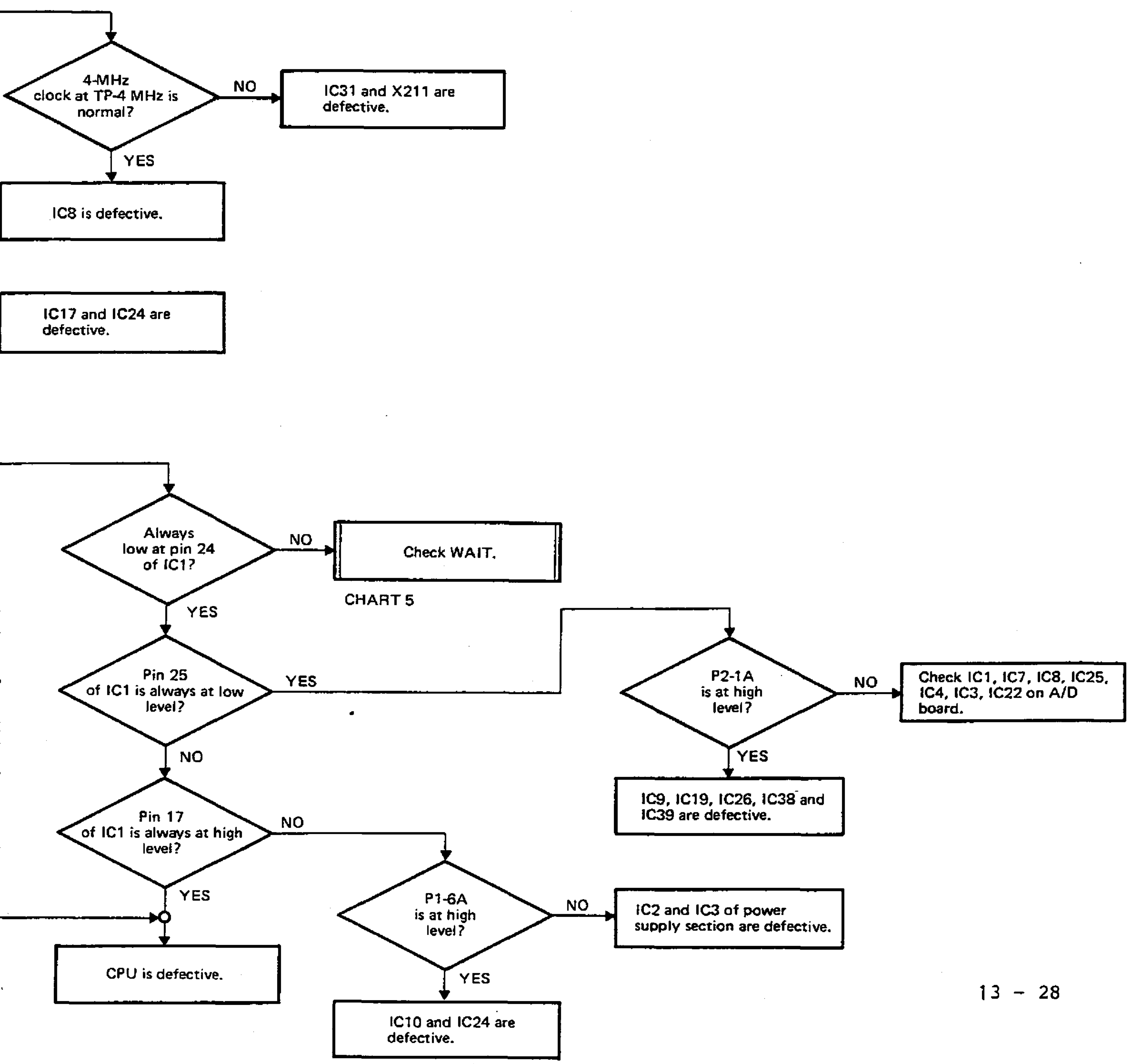

4-MHz clock at TP-4 MHz is normal?
NO
IC31 and X211 are defective.
YES
IC8 is defective.
IC17 and IC24 are defective.
Always low at pin 24 of IC1?
NO
Check WAIT.
CHART 5
YES
Pin 25 of IC1 is always at low level?
YES
P2-1A is at high level?
NO
Check IC1, IC7, IC8, IC25, IC4, IC3, IC22 on A/D board.
YES
IC9, IC19, IC26, IC38 and IC39 are defective.
NO
Pin 17 of IC1 is always at high level?
NO
P1-6A is at high level?
NO
IC2 and IC3 of power supply section are defective.
YES
IC10 and IC24 are defective.
YES
CPU is defective.

CHART 5 WAIT

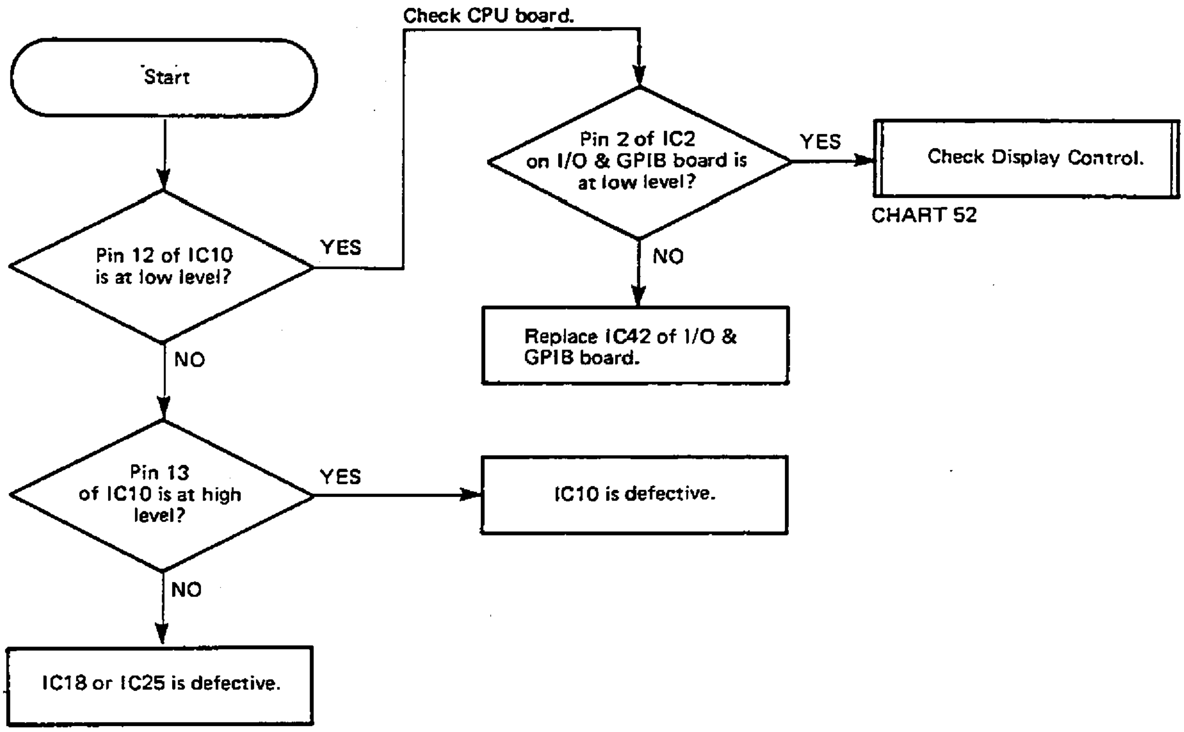
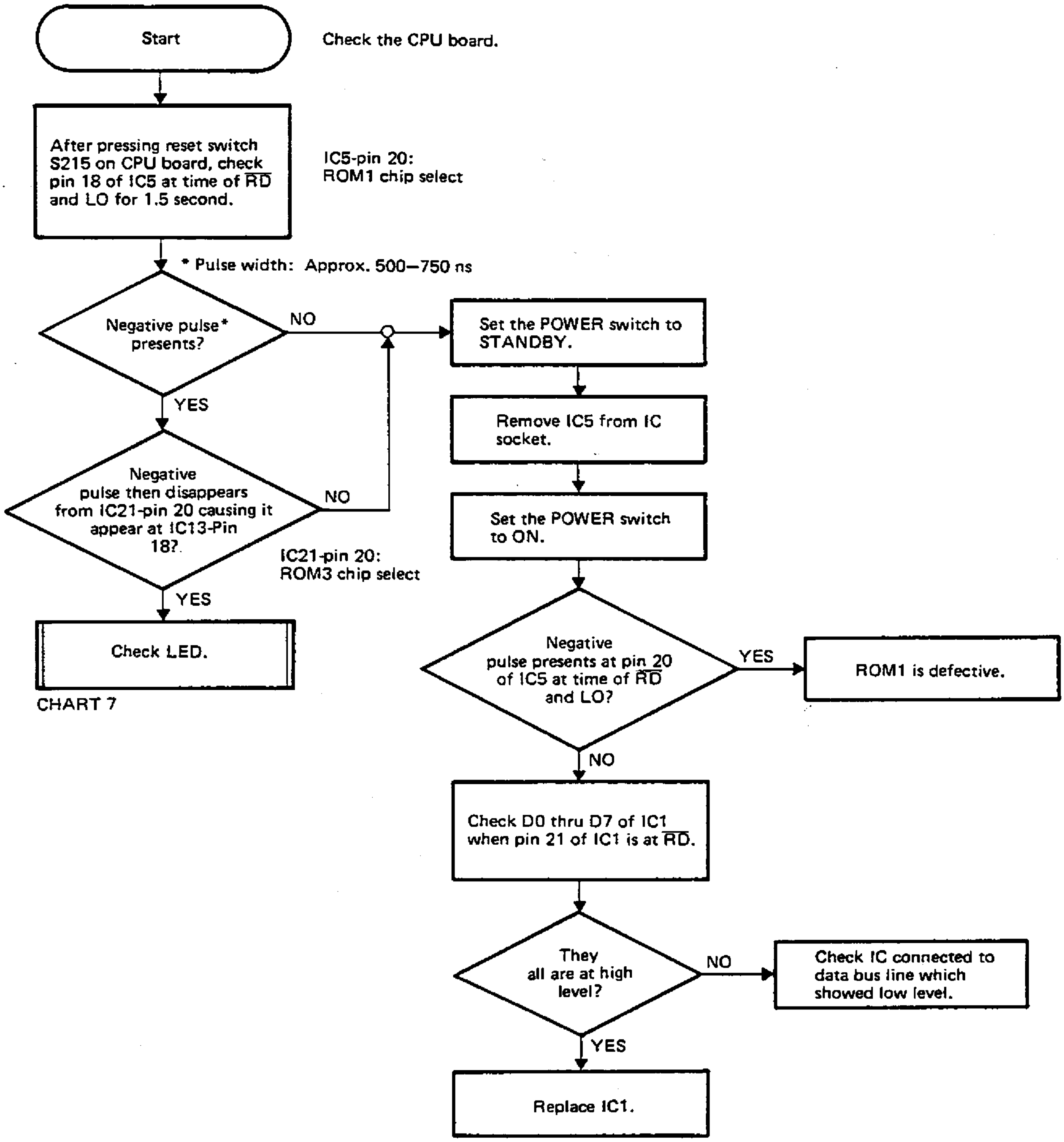
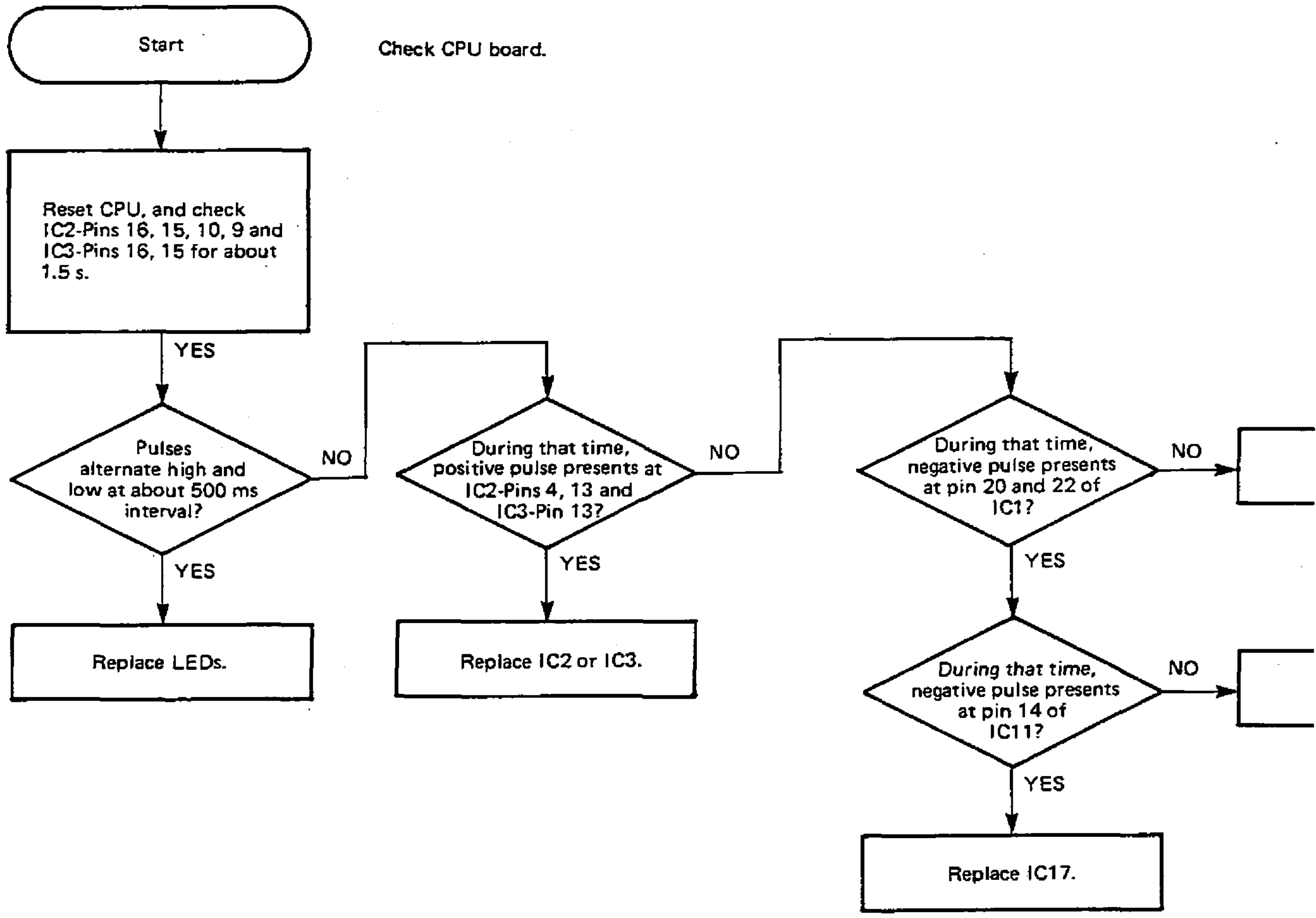

Start
Pin 12 of IC10 is at low level?
YES
Check CPU board.
Pin 2 of IC2 on I/O & GPIB board is at low level?
YES
Check Display Control.
CHART 52
NO
Replace IC42 of I/O & GPIB board.
NO
Pin 13 of IC10 is at high level?
YES
IC10 is defective.
NO
IC18 or IC25 is defective.

CHART 6 ROM1



Start
Check the CPU board.
After pressing reset switch S215 on CPU board, check pin 18 of IC5 at time of $\overline{RD}$ and LO for 1.5 second.
IC5-pin 20: ROM1 chip select
* Pulse width: Approx. 500–750 ns
Negative pulse* presents?
NO
YES
Negative pulse then disappears from IC21-pin 20 causing it appear at IC13-Pin 18?
NO
IC21-pin 20: ROM3 chip select
YES
Check LED.
CHART 7
Set the POWER switch to STANDBY.
Remove IC5 from IC socket.
Set the POWER switch to ON.
Negative pulse presents at pin 20 of IC5 at time of $\overline{RD}$ and LO?
YES
ROM1 is defective.
NO
Check D0 thru D7 of IC1 when pin 21 of IC1 is at $\overline{RD}$.
They all are at high level?
NO
Check IC connected to data bus line which showed low level.
YES
Replace IC1.

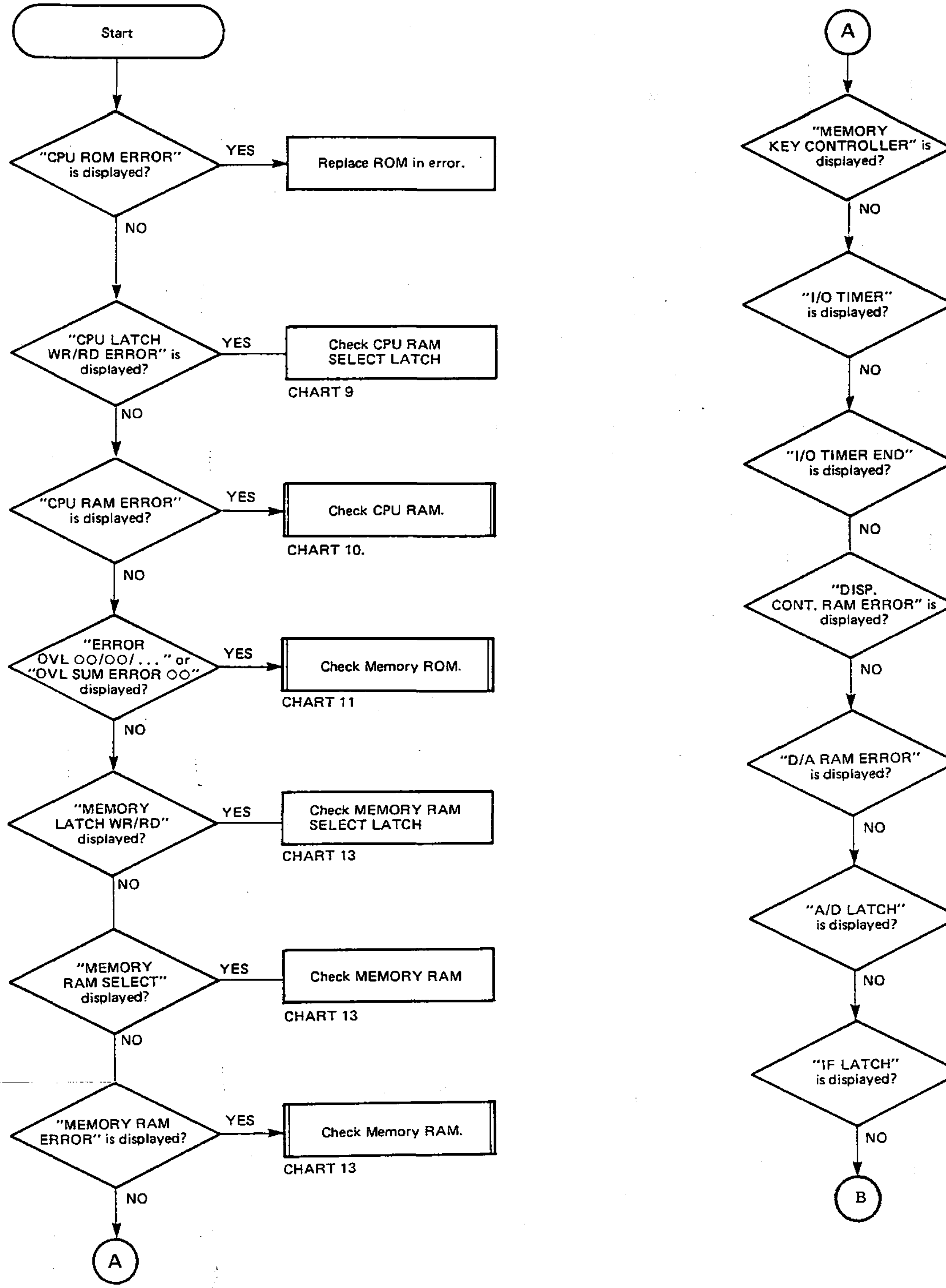
CHART 7 LED

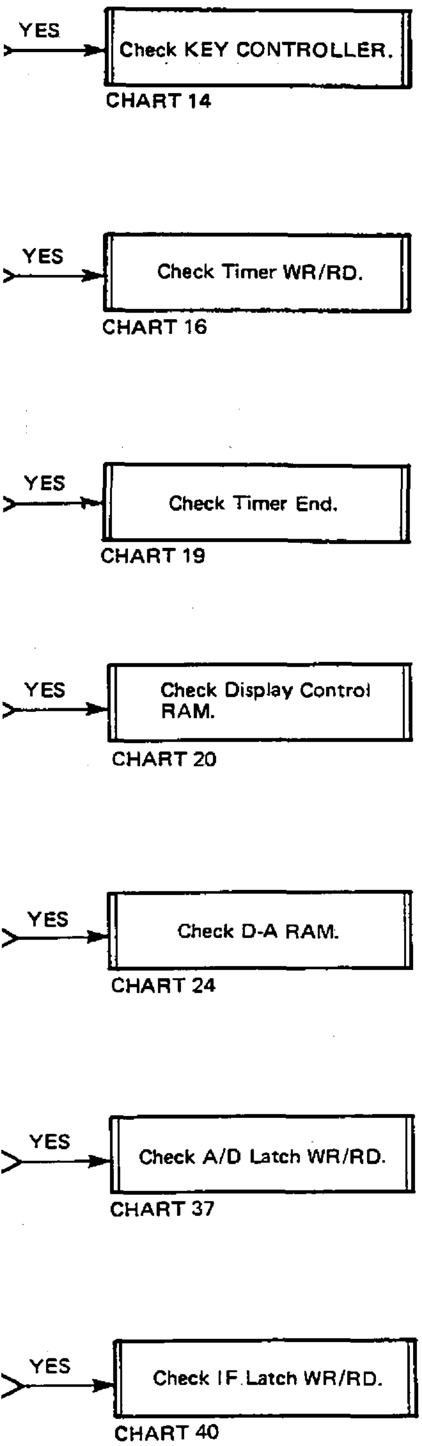

Start
Check CPU board.
Reset CPU, and check IC2-Pins 16, 15, 10, 9 and IC3-Pins 16, 15 for about 1.5 s.
YES
Pulses alternate high and low at about 500 ms interval?
NO
YES
Replace LEDs.
During that time, positive pulse presents at IC2-Pins 4, 13 and IC3-Pin 13?
NO
YES
Replace IC2 or IC3.
During that time, negative pulse presents at pin 20 and 22 of IC1?
NO
YES
During that time, negative pulse presents at pin 14 of IC11?
NO
YES
Replace IC17.

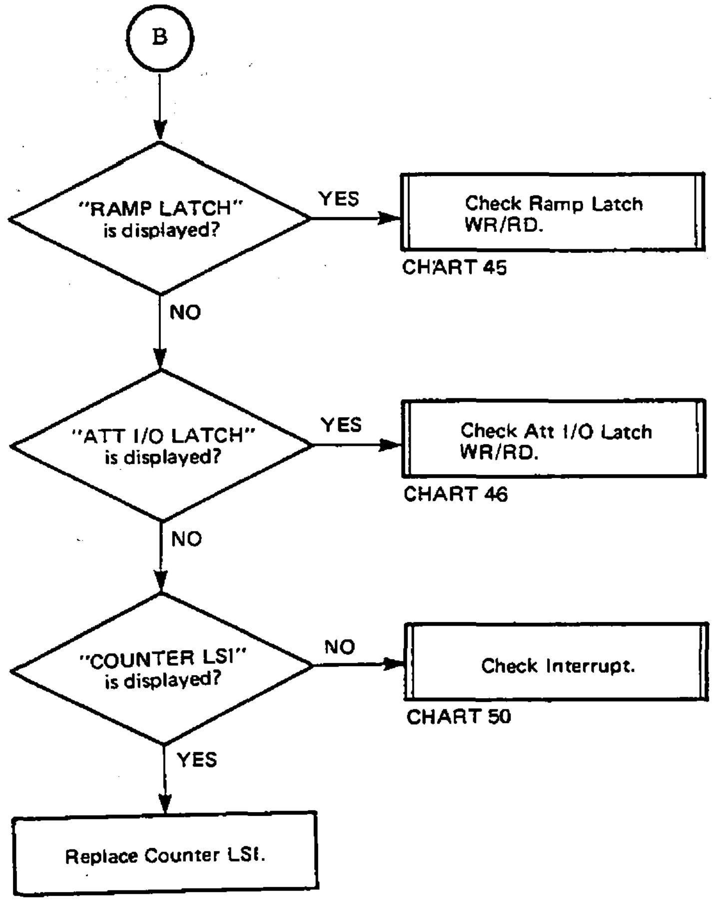
Replace IC1.

Replace IC11.

CHART 8 Error Diagnostics




YES
Check KEY CONTROLLER.
CHART 14
YES
Check Timer WR/RD.
CHART 16
YES
Check Timer End.
CHART 19
YES
Check Display Control RAM.
CHART 20
YES
Check D-A RAM.
CHART 24
YES
Check A/D Latch WR/RD.
CHART 37
YES
Check IF Latch WR/RD.
CHART 40


B
"RAMP LATCH" is displayed?
YES
Check Ramp Latch WR/RD.
CHART 45
NO
"ATT I/O LATCH" is displayed?
YES
Check Att I/O Latch WR/RD.
CHART 46
NO
"COUNTER LSI" is displayed?
NO
Check Interrupt.
CHART 50
YES
Replace Counter LSI.

Error Display of Self-Check Test (Error Table)

CPU board LEDs 1 = ON 0 = OFF MSB LSB 5 4 3 2 1 0	Display on CRT	Board to be checked	IC to be checked	Corre-sponding address or data bit	Notes
0 0 0 0 0 0	"CPU ROM ERROR 01, 02, 03" Only defective ROM No. is displayed.	BGP-010191	IC5	0000 ~ 1FFF	ROM 1
0 0 0 0 0 1			IC14	2000 ~ 3FFF	ROM 2
0 0 0 0 1 0			IC21	4000 ~ 5FFF	ROM 3
0 0 0 1 1 0	"ERROR OVL 02/01/00/03/04/05/06/07"	BGP-010192	IC1	E000 ~ FFFF	ROM A 0
0 0 0 1 1 1	Displayed when ROMs are displaced.		IC2	E000 ~ FFFF	ROM B 1
0 0 1 0 0 0	In the above example, ROM A and ROM C are displaced. In the overlay ROM, status (ROM No.) is written at the first address of each ROM (A–H). Status check is started with ROM A to ROM H in 0-1-2-3-4-5-6-7 sequence; when ROM numbers are not in this sequence, status is displayed in the readout order.		IC3	E000 ~ FFFF	ROM C 2
0 0 1 0 0 1			IC7	E000 ~ FFFF	ROM D 3 Q latch data of port 0H = U36LS75
0 0 1 0 1 0			IC8	E000 ~ FFFF	ROM E 4
0 0 1 0 1 1			IC9	E000 ~ FFFF	ROM F 5
0 0 1 1 0 0	"OVL SUM ERROR 00 – 08" Only defective ROM No. are displayed.		IC18	E000 ~ FFFF	ROM G 6
0 0 1 1 0 1	With the status check passed, sum check for each ROM is made to display, if any, ROM number in error.		IC19	E000 ~ FFFF	ROM H 7
0 1 0 0 0 0	"CPU RAM ERROR BIT D0, D1, ..." Only bits of error are displayed.	BGP-010191	IC36	D0	Dynamic RAM of CPU address 8000 ~ BFFF.
0 1 0 0 0 1			IC37	D1	
0 1 0 0 1 0			IC29	D2	
0 1 0 0 1 1			IC30	D3	
0 1 0 1 0 0			IC22	D4	
0 1 0 1 0 1			IC23	D5	
0 1 0 1 1 0			IC15	D6	
0 1 0 1 1 1			IC16	D7	
0 1 0 1 1 1 About 500 ms 0 1 0 0 0 0 About 100 ms					"CPU RAM ERROR BIT ALL HI"
0 1 0 1 1 1 About 100 ms 0 1 0 0 0 0 About 500 ms					"CPU RAM ERROR BIT ALL LO"
0 1 1 0 0 0	"MEMORY RAM LATCH"	BGP-010192	IC26	6000 ~ 77FF	BATTERY BACKUP
0 1 1 0 0 1	"MEMORY RAM SELECT"				
0 1 1 0 1 0	"MEMORY RAM ERROR"				

CPU board LEDs MSB LSB 5 4 3 2 1 0	Display on CRT	Board to be checked	IC to be checked	Corre-sponding address	Notes
1 0 0 0 0 0	"D/A RAM IC1, IC10, " Defective IC display	BGP-010188	IC1	D000 ~ D3FF	Higher position Trace A marker
1 0 0 0 0 1			IC2	C000 ~ C7FF	Byte of odd number Lower position Trace A
1 0 0 0 1 0			IC4	C000 ~ C7FF	Byte of even number Higher position
1 0 0 0 1 1			IC3	C000 ~ C7FF	Byte of even number Lower position
1 0 0 1 0 0			IC10	D400 ~ D7FF	Upper position Trace B marker
1 0 0 1 0 1			IC11	C800 ~ CFFF	Byte of odd number Lower position Trace B
1 0 0 1 1 0			IC13	C800 ~ CFFF	Byte of even number Upper position
1 0 0 1 1 1			IC12	C800 ~ CFFF	Byte of even number Lower position
1 0 1 0 0 0			IC20	D800 ~ DBFF	4 MSBs Position X line
1 0 1 0 0 1			IC22	D800 ~ DBFF	4 bits of middle position Y line
1 0 1 0 1 0			IC21	D800 ~ DBFF	4 LSBs Character
1 0 1 0 1 1			IC31	DC00 ~ DBFF	4 MSBs Character
1 0 1 1 0 0			IC30	DC00 ~ DBFF	4 LSBs
1 1 0 0 0 0	"MEMORY KEY CONTROLLER"	BGP-010192	MEMORY IC13	7810 7811	
1 1 0 0 0 1	"I/O TIMER END"	BGP-010190	I/O IC19	7830 ~ 7833	
1 1 0 0 1 0	"I/O TIMER"		I/O IC19, 18	7834	
1 1 0 1 0 0	"DISP. CONT. RAM ERROR IC34, IC44"	BGP-010189	DISP. CONT. IC34, 44, 24	7860 ~ 780F	
1 1 0 1 0 1	"A/D LATCH"	BGP-010187	A/D IC32, 26	7870	
1 1 0 1 1 0	"IF LATCH"	BLP-010230	IF-2 IC13, 15	7883	
1 1 0 1 1 1	"RAMP LATCH"	BGP-010185	RAMP IC19, 14	7889	
1 1 1 0 0 0	"ATT I/O LATCH"	BGN-010220	ATT I/O IC28, 27	7851 7852	
1 1 1 0 0 1	"COUNTER LSI"	BLJ-010131	COUNTER IC12, 13	7851 7852	
1 1 1 0 1 1	"INTERRUPT ○○" Type of INT				02: KEY CONTROL 04: GPIB 08: SWEEP END 0A: TIMER 0C: SWEEP STOP 0E: COUNTER 10: QP 12: OPTION

CHART 9 CPU:RAM SELECT LATCH ERROR

In case of this error, CPU continues to write/read 55H at I/O port 40H (D0—D3 of IC13).

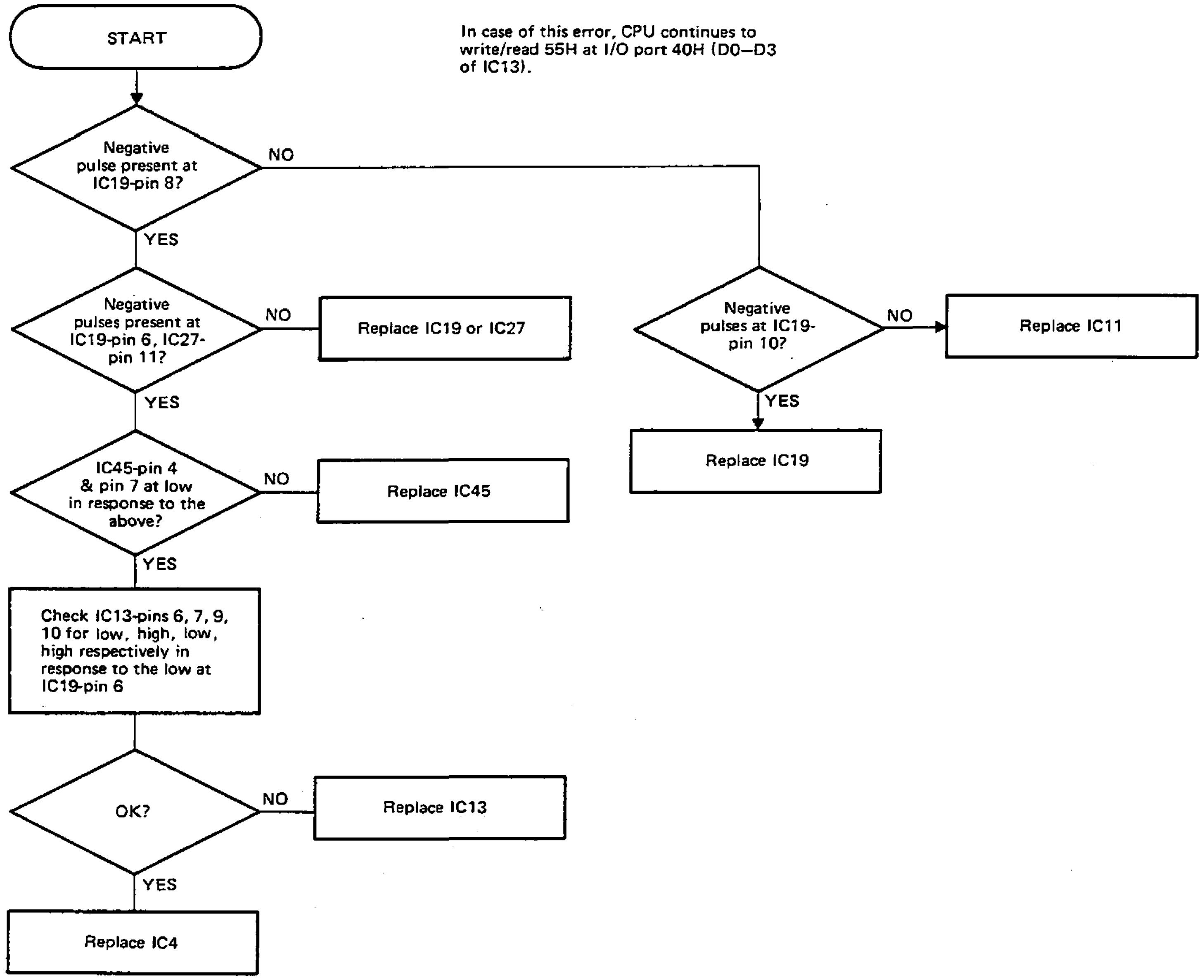
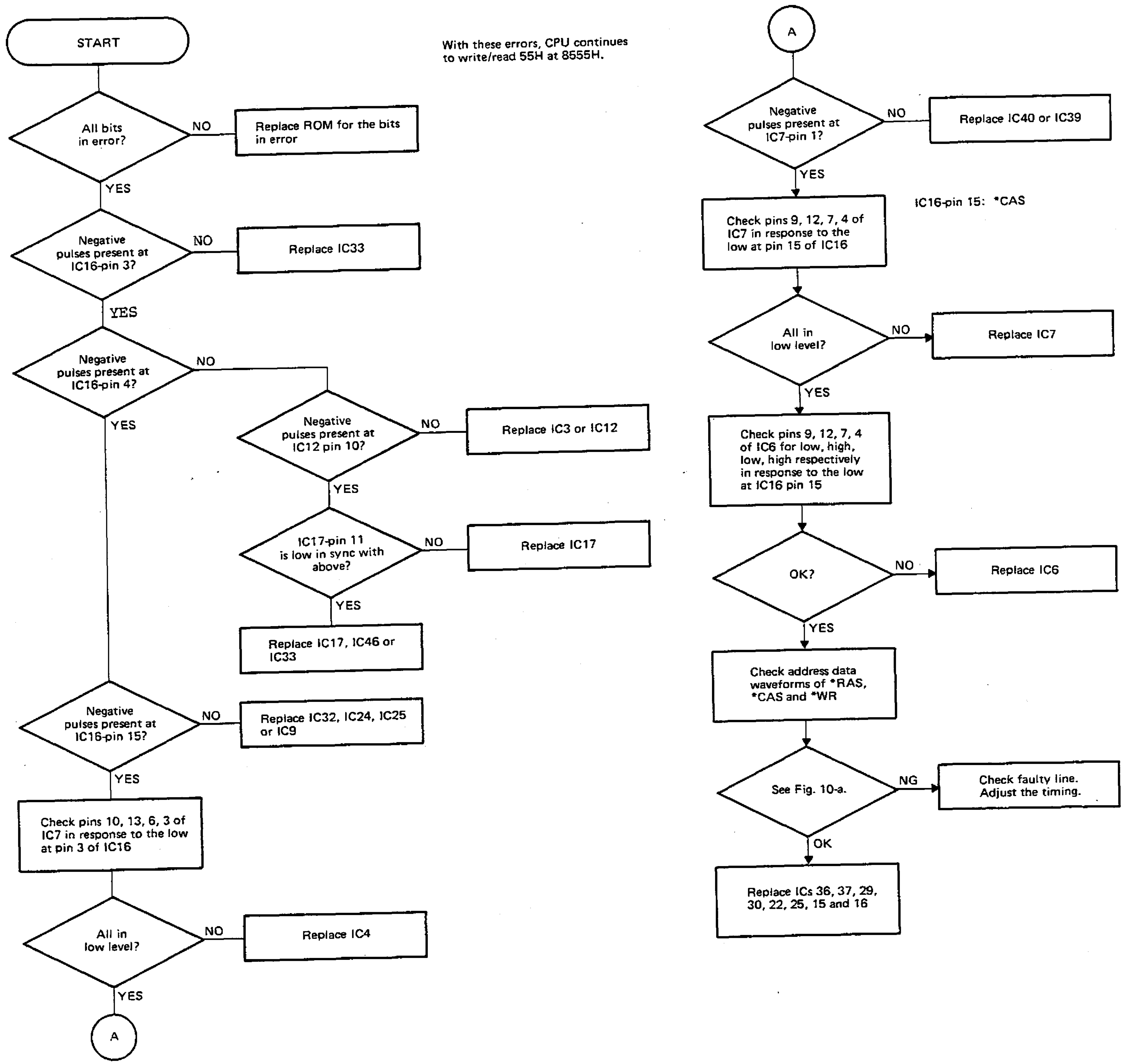


CHART 10 CPU RAM SELECT ERROR
RAM WR/RD ERROR



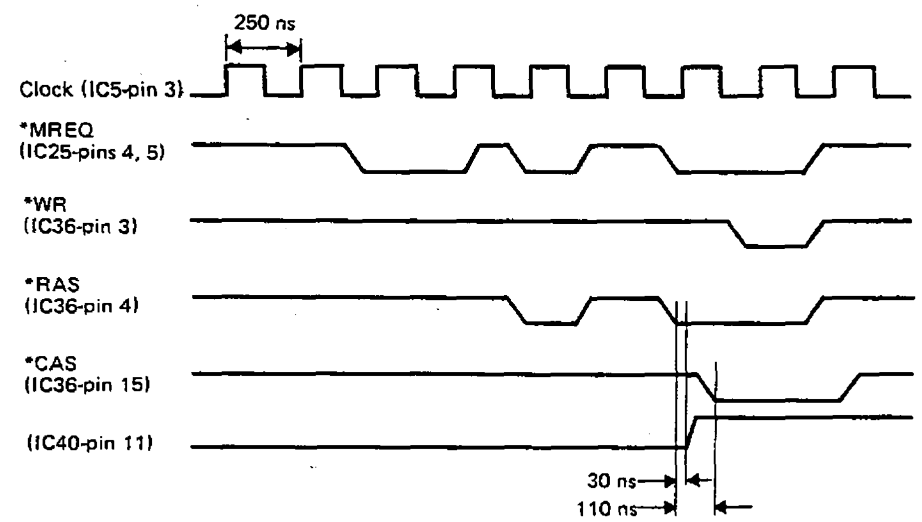


Fig. 10-a

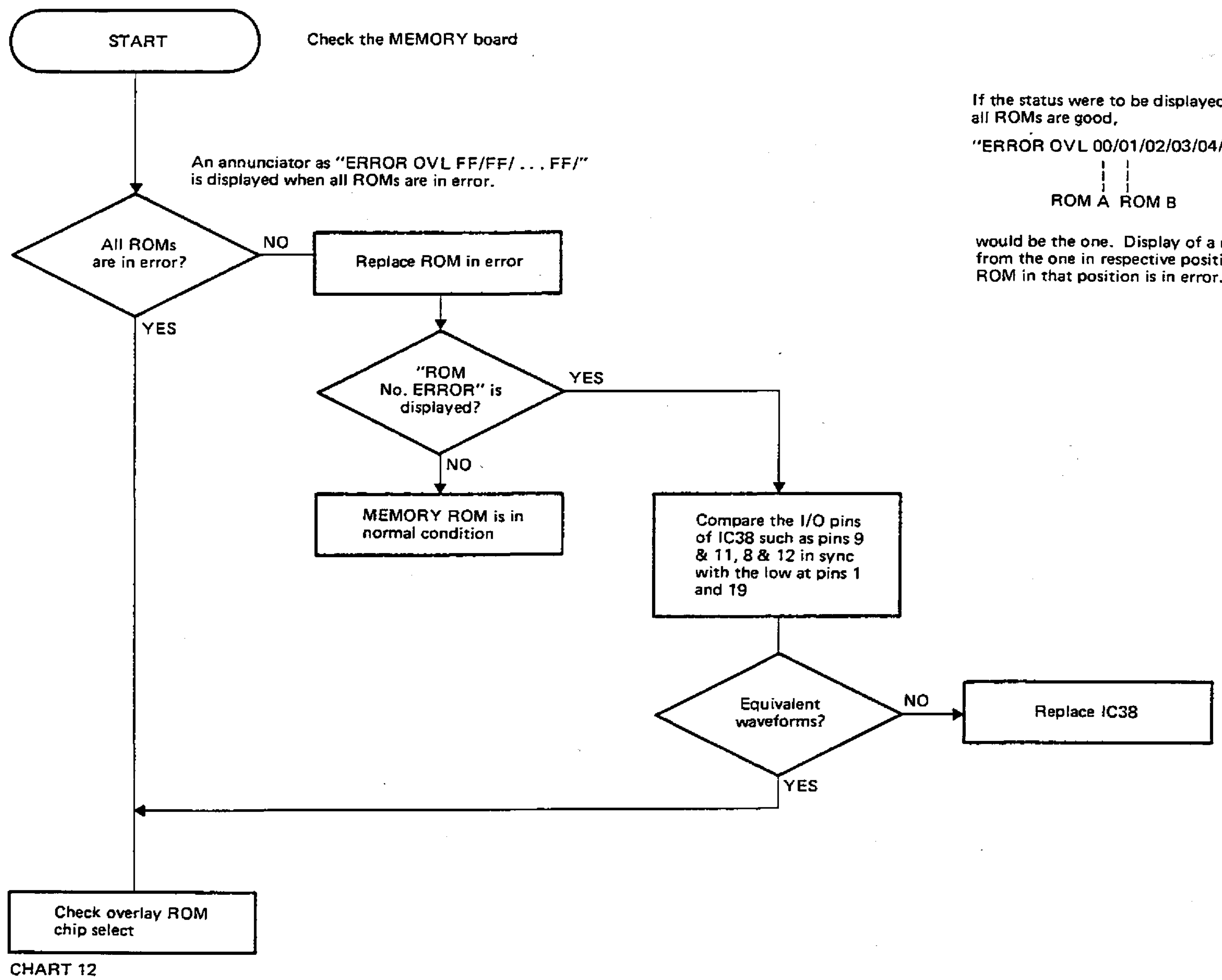
OPERATION OF CPU ON TROUBLESHOOTING

Error mode		WR/RD ADDRESS	WR/RD DATA	LED	WR/RD	ERROR MESSAGE
Main ROM 3		5555H	55H		WR,RD	CPU ROM 03 ERROR
Main ROM 1-3		5555H	55H	0-2H	WR,RD	CPU ROM ERROR
Dynamic RAM		8555H	55H	10H-17H	WR,RD	CPU RAM ERROR
Dynamic RAM		Port 40H	55H	26H	WR	CPU RAM LATCH
Overlay ROM (No.)		E555H	55H	6H-EH	WR,RD	ERROR OVL
Overlay ROM (SUM)		E555H	55H	6H-EH	WR,RD	OVL SUM ERROR
Backup RAM	LATCH	Port 10H	55H	18H	WR,RD	MEMORY RAM LATCH
	RAM SELECT	6000H	55H	19H	WR,RD	MEMORY RAM SELECT
	RAM WR/RD	6000H/6800H/ 7000H	55H	1AH	WR,RD	MEMORY RAM ERROR
Key Controller		7810H	55H	30H	WR,RD	MEMORY KEY CON-TROLLER
Timer End		7833H	55H	31H	WR,RD	I/O TIMER END
Timer Counter		7833H	55H	32H	WR,RD	I/O TIMER
Display Control RAM		7865H	55H	34H	WR,RD	DISP.CONT.RAM ERROR
A/D Latch		7870H	55H	35H	WR,RD	A/D LATCH
IF Latch		7883H	55H	36H	WR,RD	IF LATCH
Lamp Latch		7898H	55H	37H	WR,RD	LAMP LATCH
Att I/O Latch		7851H	55H	38H	WR,RD	ATT I/O LATCH
Counter LSI				39H		COUNTER LSI
D/A RAM	IC1	D055H	55H	20H	WR,RD	D/A RAM
	IC2,3,4	C054H,55H	5555H	21H,23H,22H	WR,RD	
	IC10	D455H	55H	24H	WR,RD	
	IC11,12,13	C854H,55H	5555H	25H,27H,26H	WR,RD	
	IC20,21,22	D854H,55H	5555H	28H,2AH,29H	WR,RD	
	IC30,31	DC55H	55H	2CH,2BH	WR,RD	
Interrupt						INTERRUPT ERROR

(NOTES)

- o In case of errors at the time of initial checks, CPU forms a loop in which the data are written into or read from the WR/RD address corresponding to respective error mode.
- o In the event of errors for Counter LSI and Interrupt, CPU repeats check routine.
- o This operation of CPU corresponds to the LED display on the CPU board. (1:ON, 0:OFF)

CHART 11 MEMORY ROM



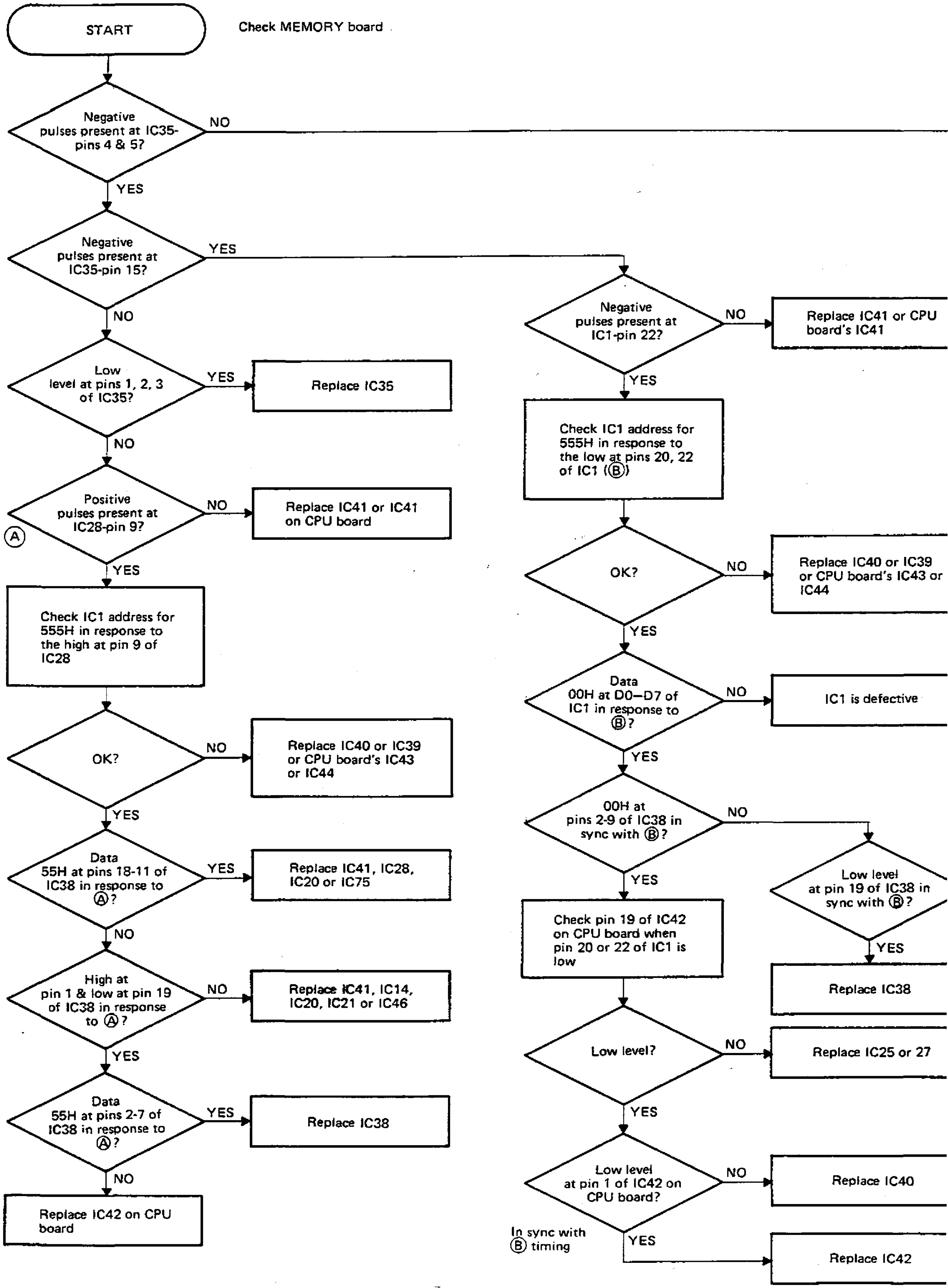
If the status were to be displayed in which all ROMs are good,

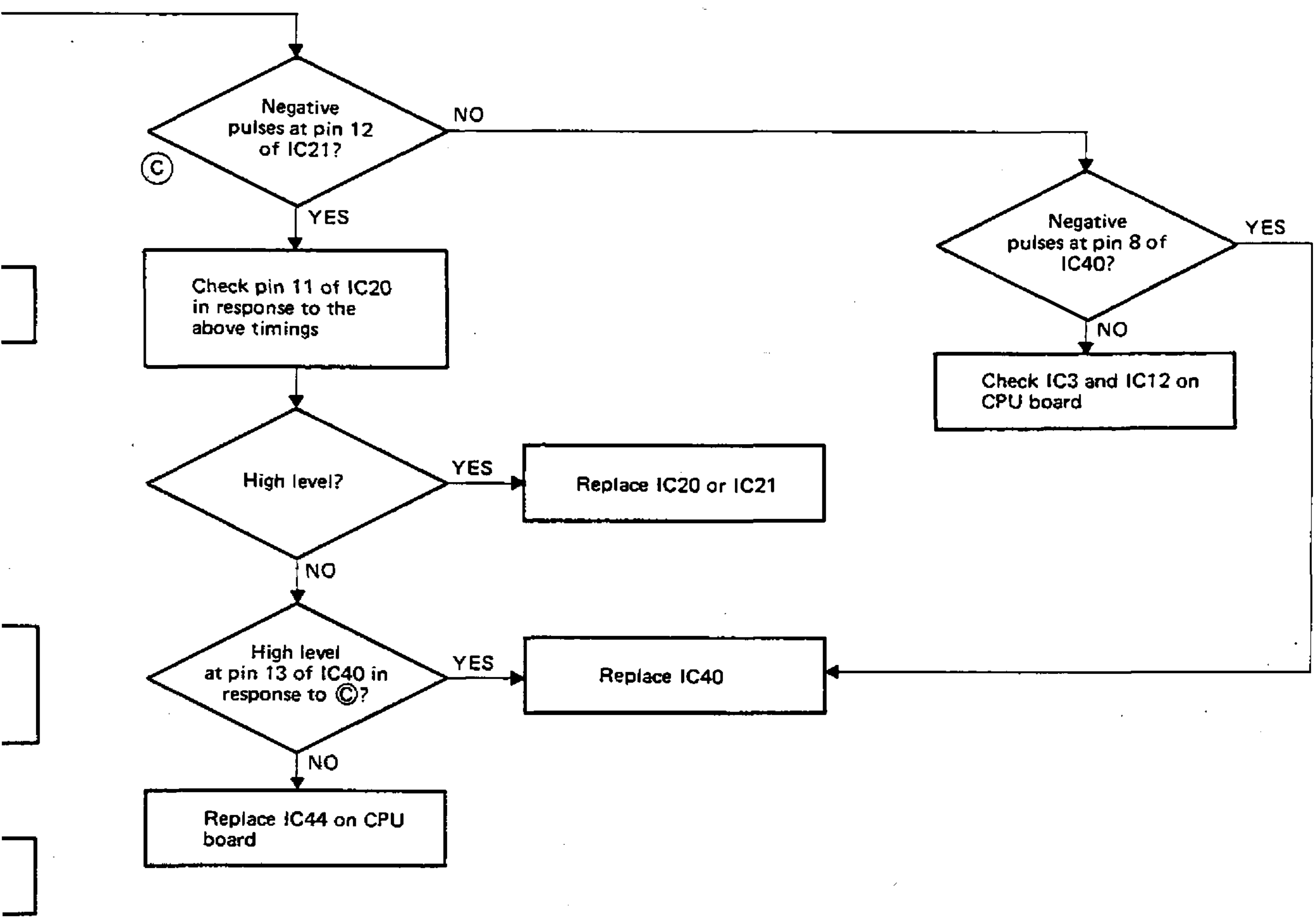
"ERROR OVL 00/01/02/03/04/05/06/07/"

ROM A ROM B ROM H

would be the one. Display of a number different from the one in respective position means the ROM in that position is in error.

CHART 12 OVERLAY ROM CHIP SELECT




Negative pulses at pin 12 of IC21?
NO
YES
Check pin 11 of IC20 in response to the above timings
High level?
YES
Replace IC20 or IC21
NO
High level at pin 13 of IC40 in response to ©?
YES
Replace IC40
NO
Replace IC44 on CPU board
Negative pulses at pin 8 of IC40?
YES
NO
Check IC3 and IC12 on CPU board

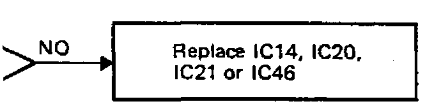
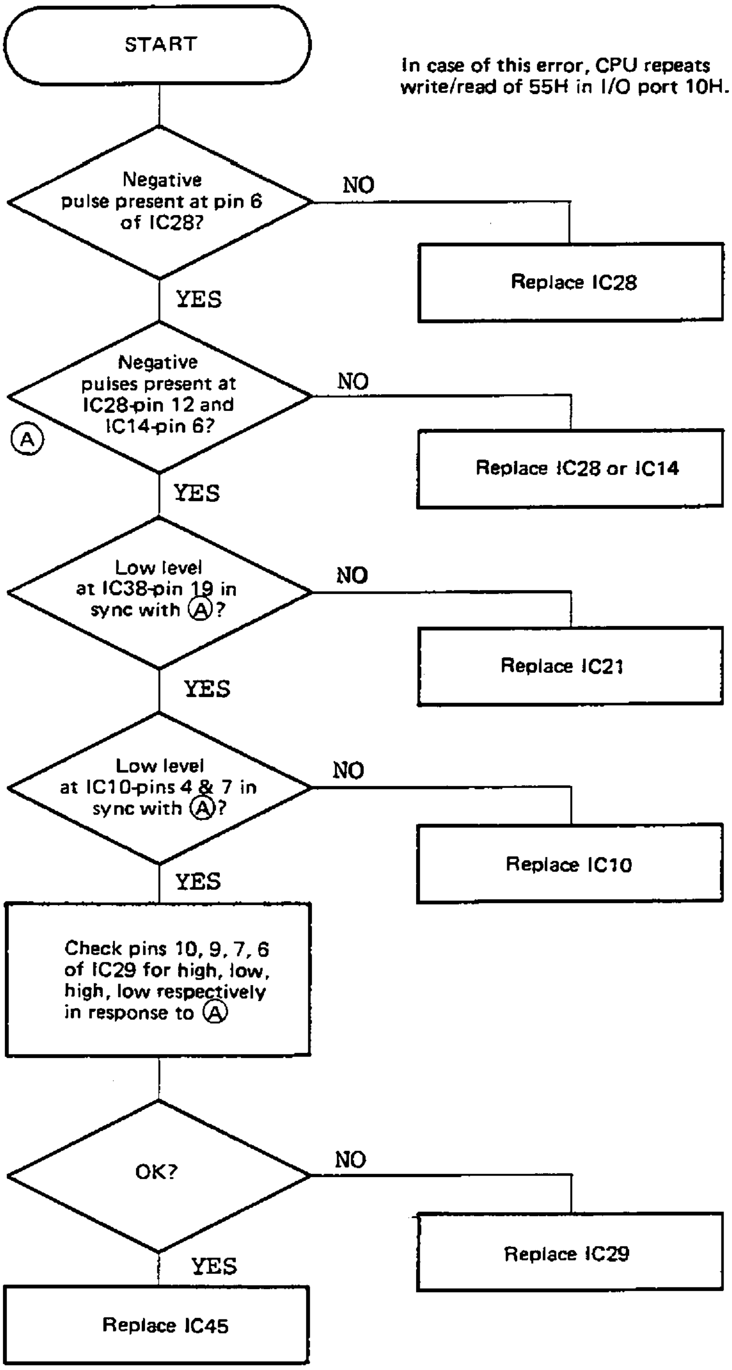

NO
Replace IC14, IC20, IC21 or IC46

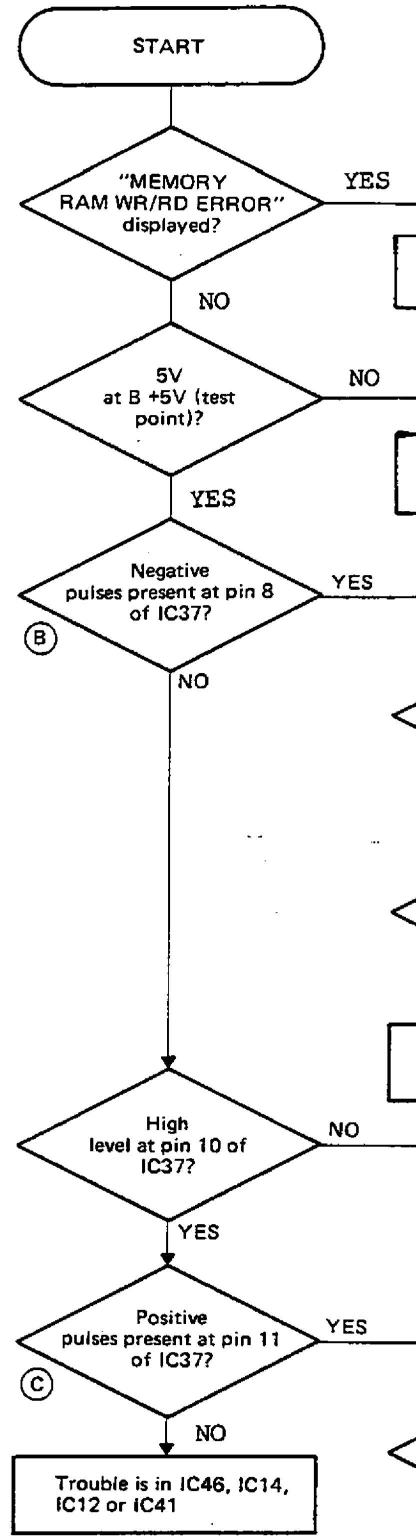
CHART 13 MEMORY RAM

(1) RAM SELECT LATCH ERROR

In case of this error, CPU repeats write/read of 55H in I/O port 10H.



(2) RAM SELECT ERROR
RAM WR/RD ERROR



In the normal condition, A13 is high, A11 and A12 are low in sync with the low at P1-10A (IC40-pin 11).

When this type of error occurs, CPU continues to write/read 55H in 6000H.

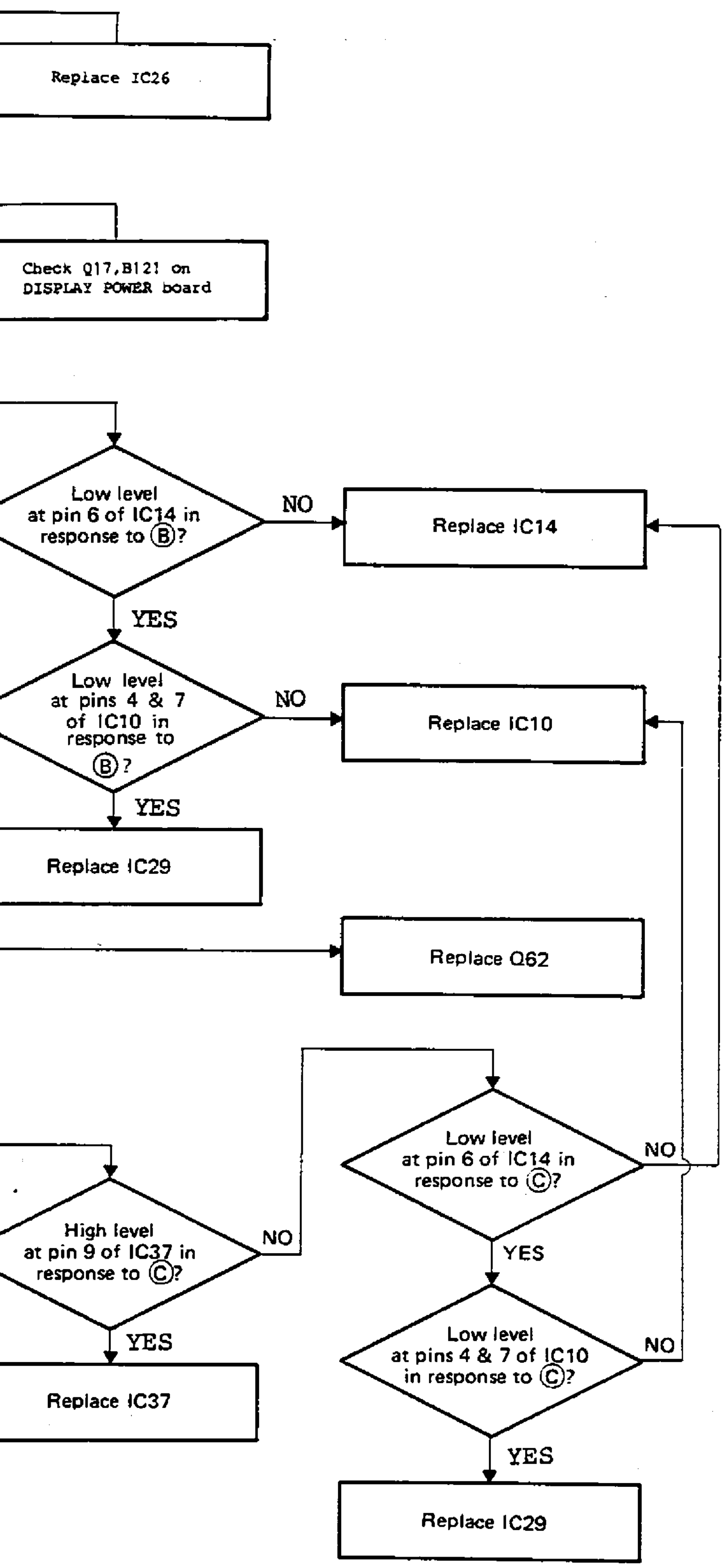


CHART 14 KEY CONTROLLER

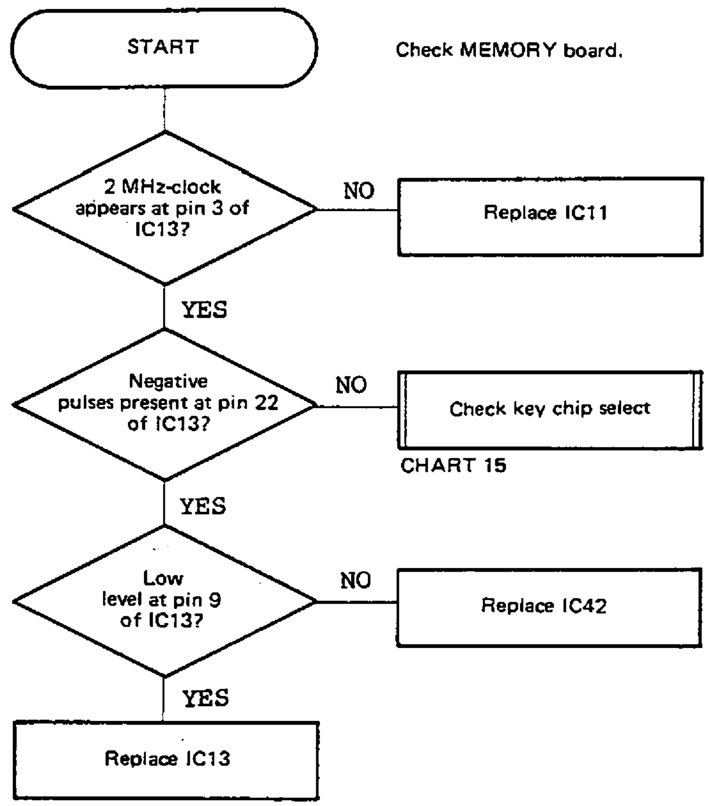
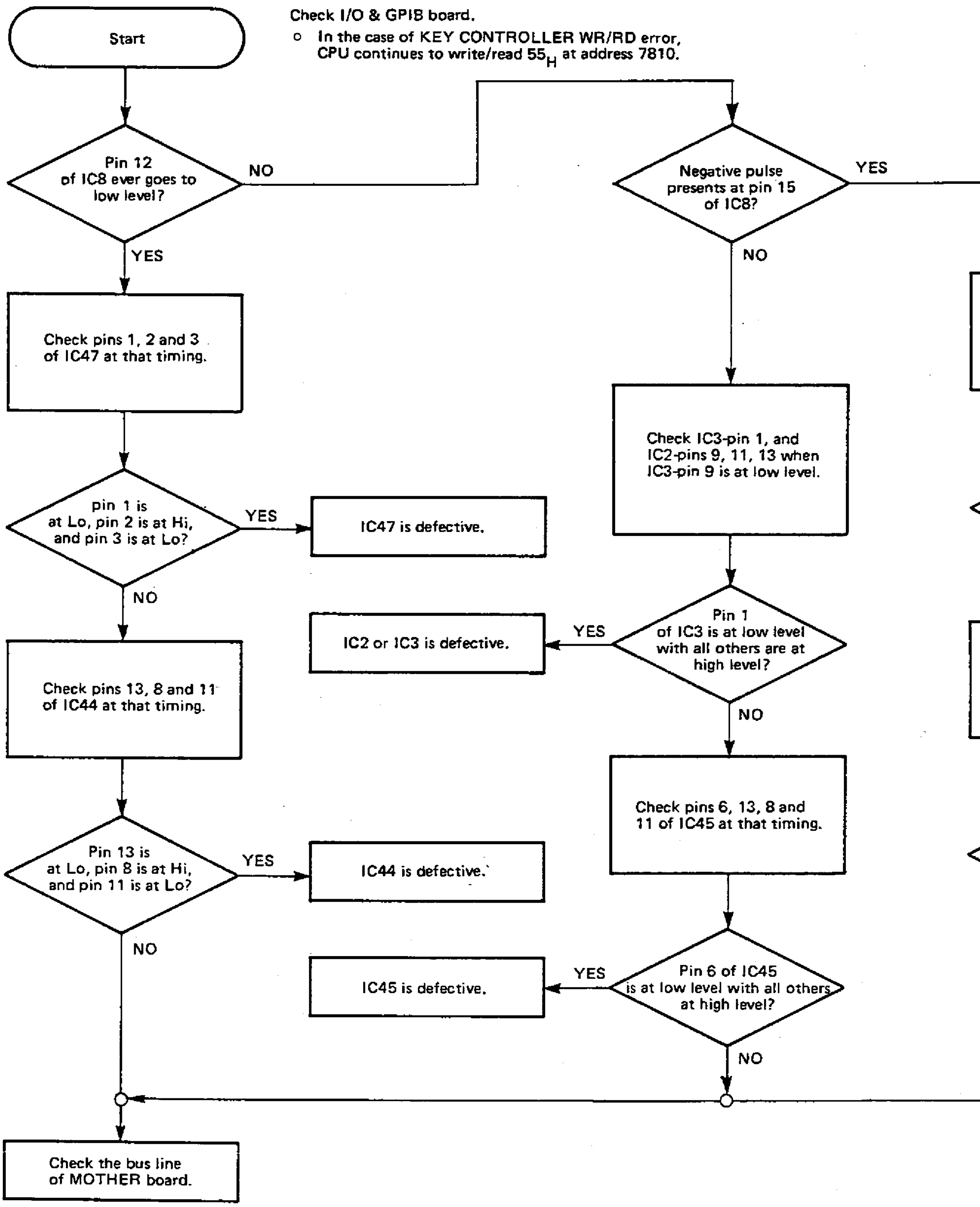


CHART 15 Key Chip Select



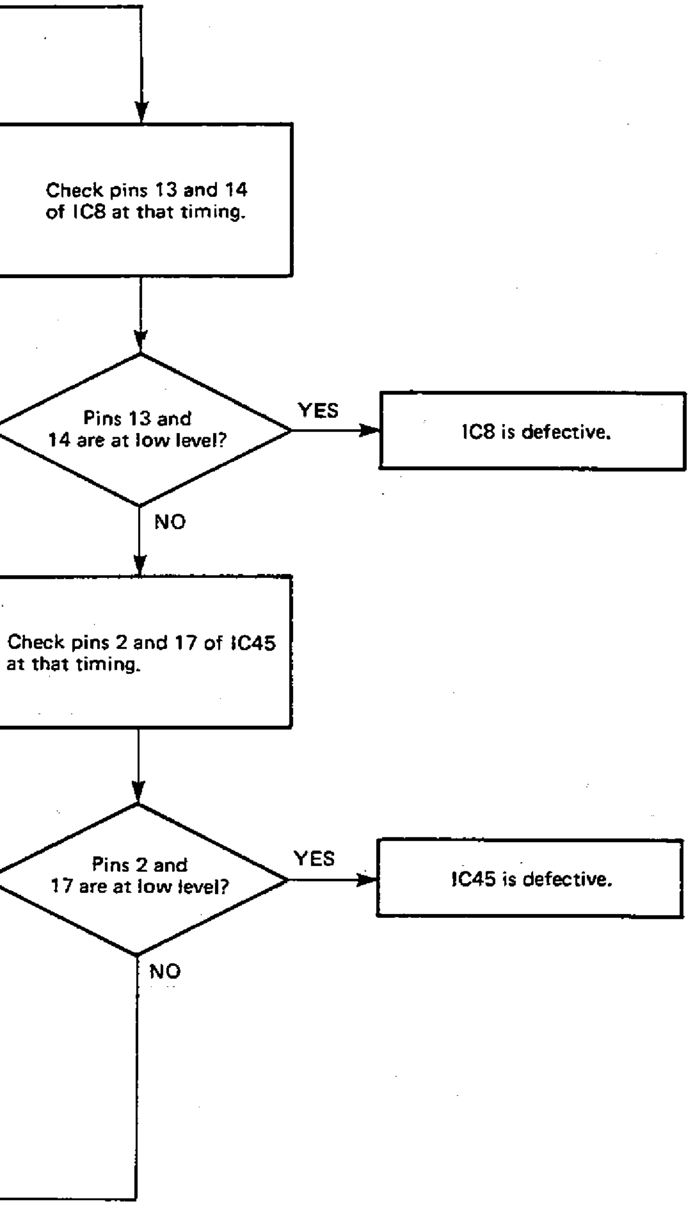

Check pins 13 and 14
of IC8 at that timing.
Pins 13 and
14 are at low level?
YES
IC8 is defective.
NO
Check pins 2 and 17 of IC45
at that timing.
Pins 2 and
17 are at low level?
YES
IC45 is defective.
NO

CHART 16 Timer WR/RD

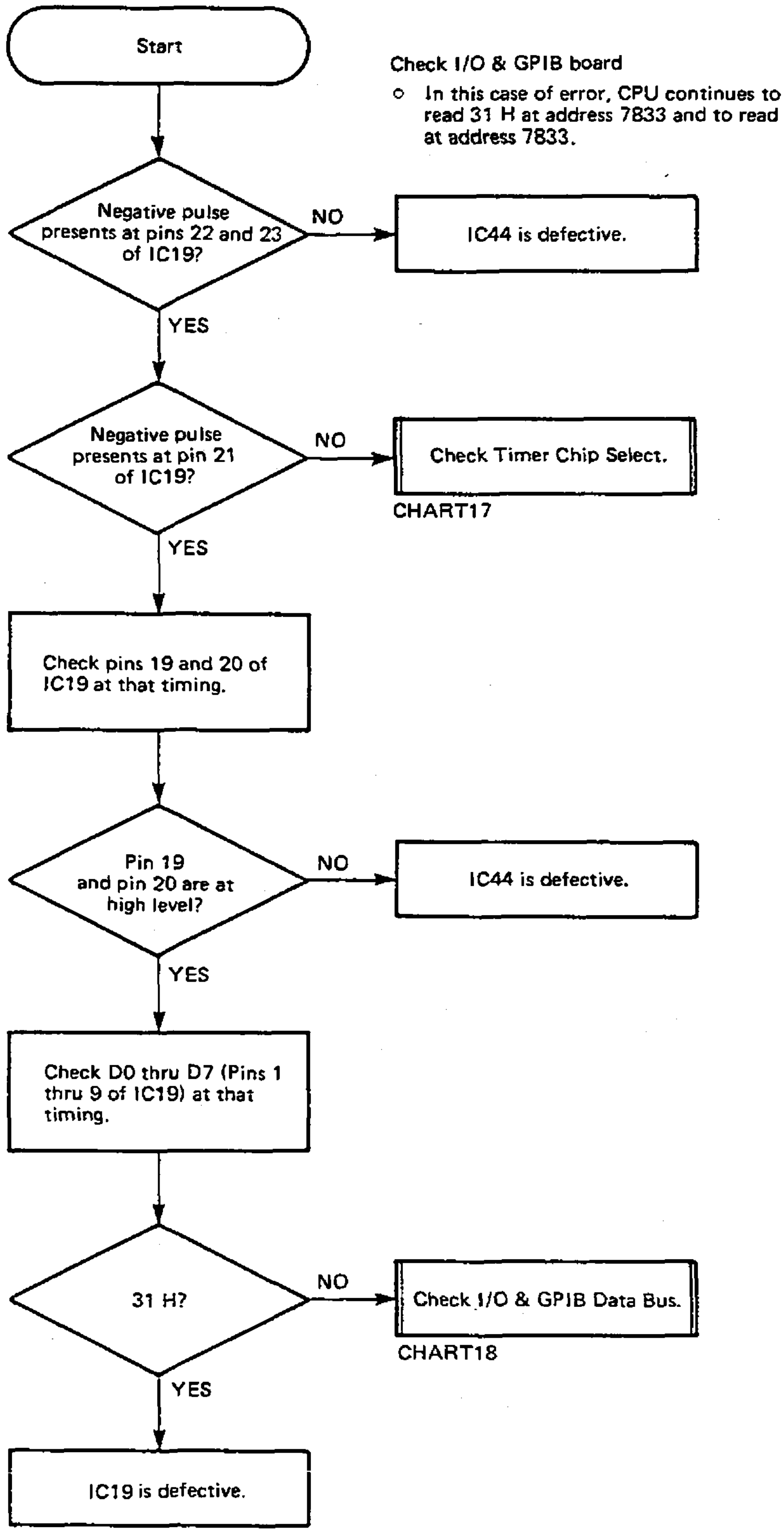


CHART 17 Timer Chip Select

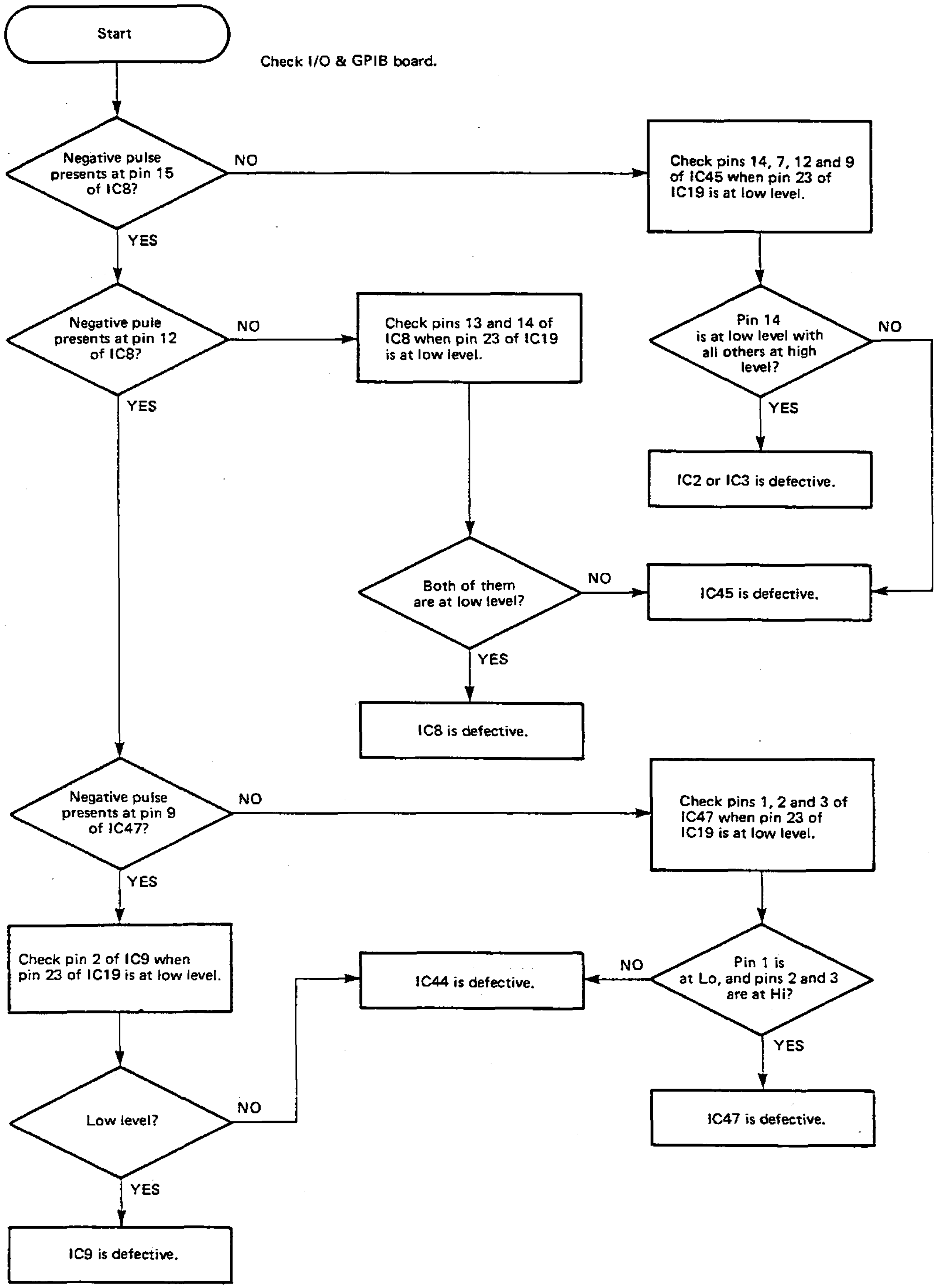
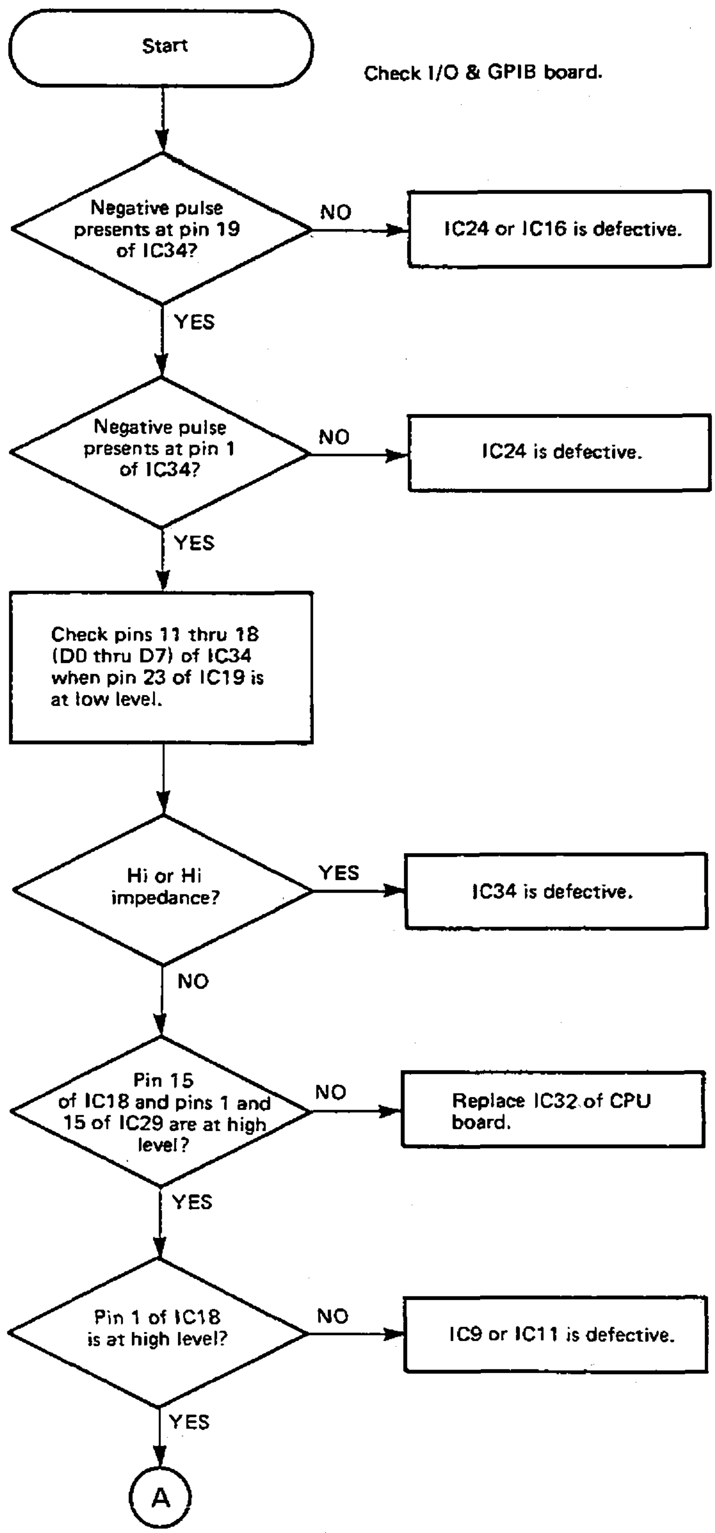


CHART 18 I/O & GPIB Data Bus



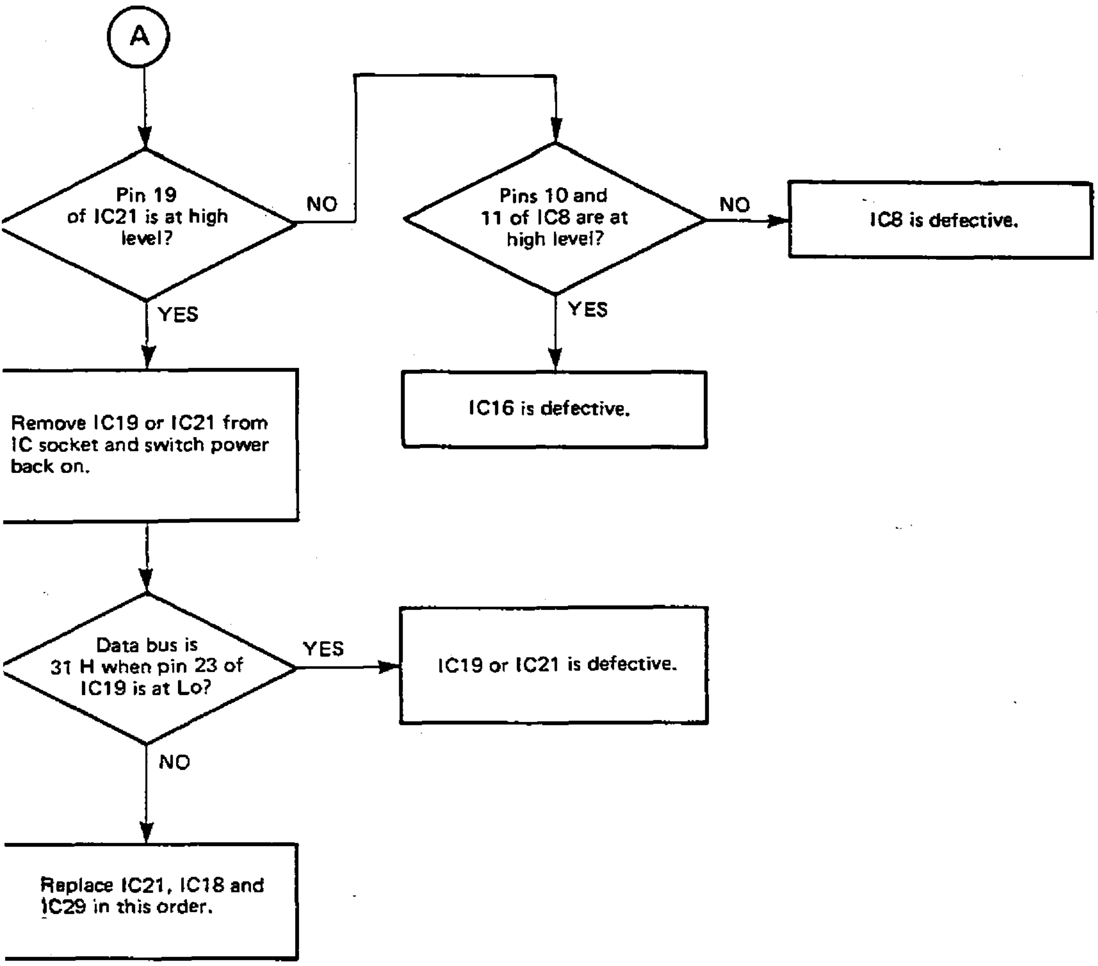

A
Pin 19 of IC21 is at high level?
NO
Pins 10 and 11 of IC8 are at high level?
NO
IC8 is defective.
YES
YES
Remove IC19 or IC21 from IC socket and switch power back on.
IC16 is defective.
Data bus is 31 H when pin 23 of IC19 is at Lo?
YES
IC19 or IC21 is defective.
NO
Replace IC21, IC18 and IC29 in this order.

CHART 19 Timer End

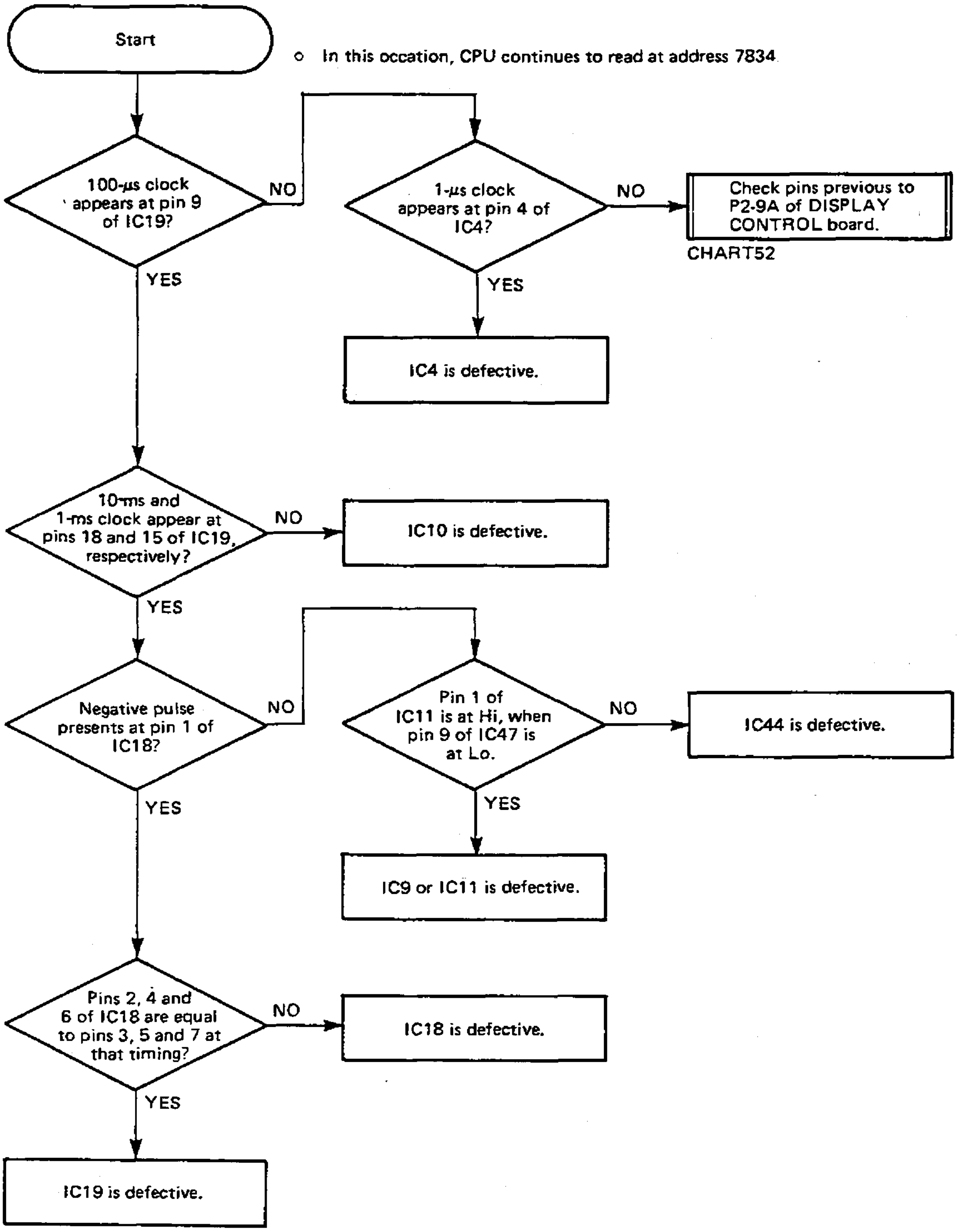
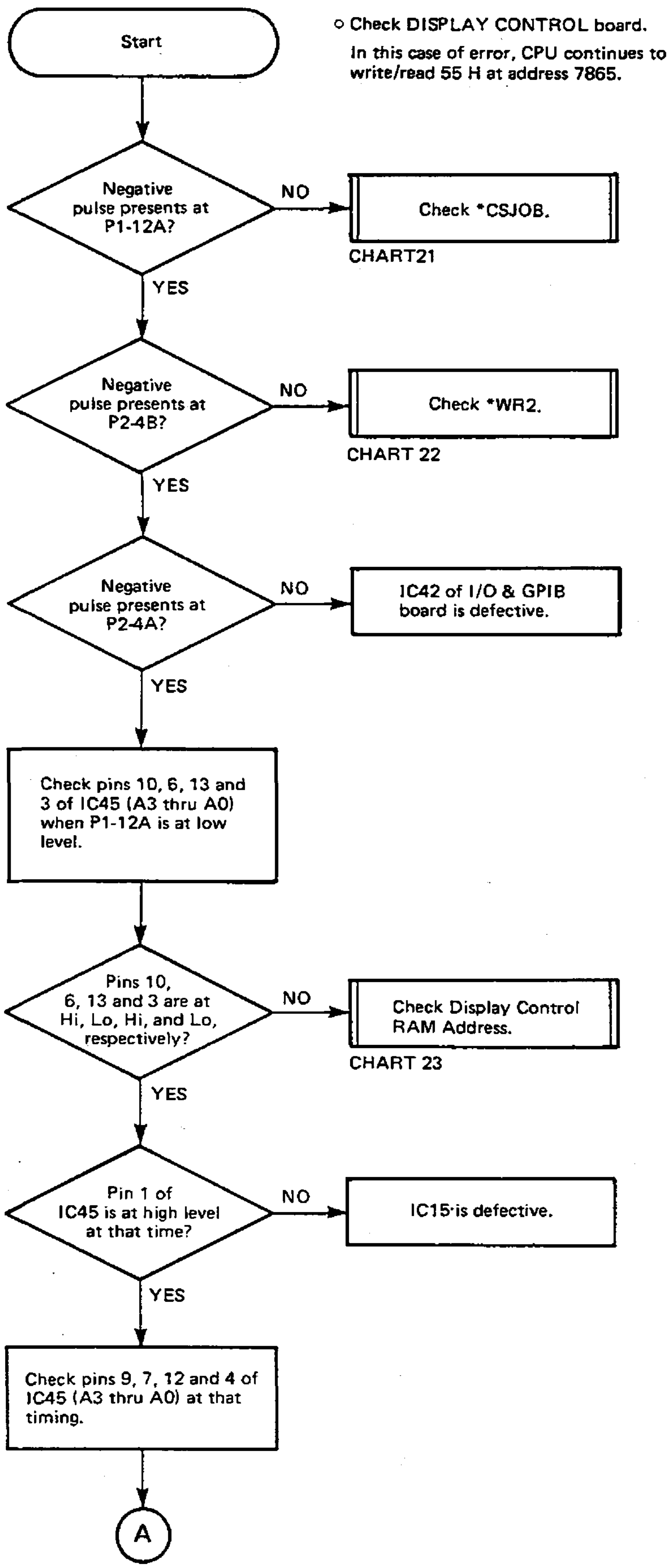


CHART 20 Display Control RAM



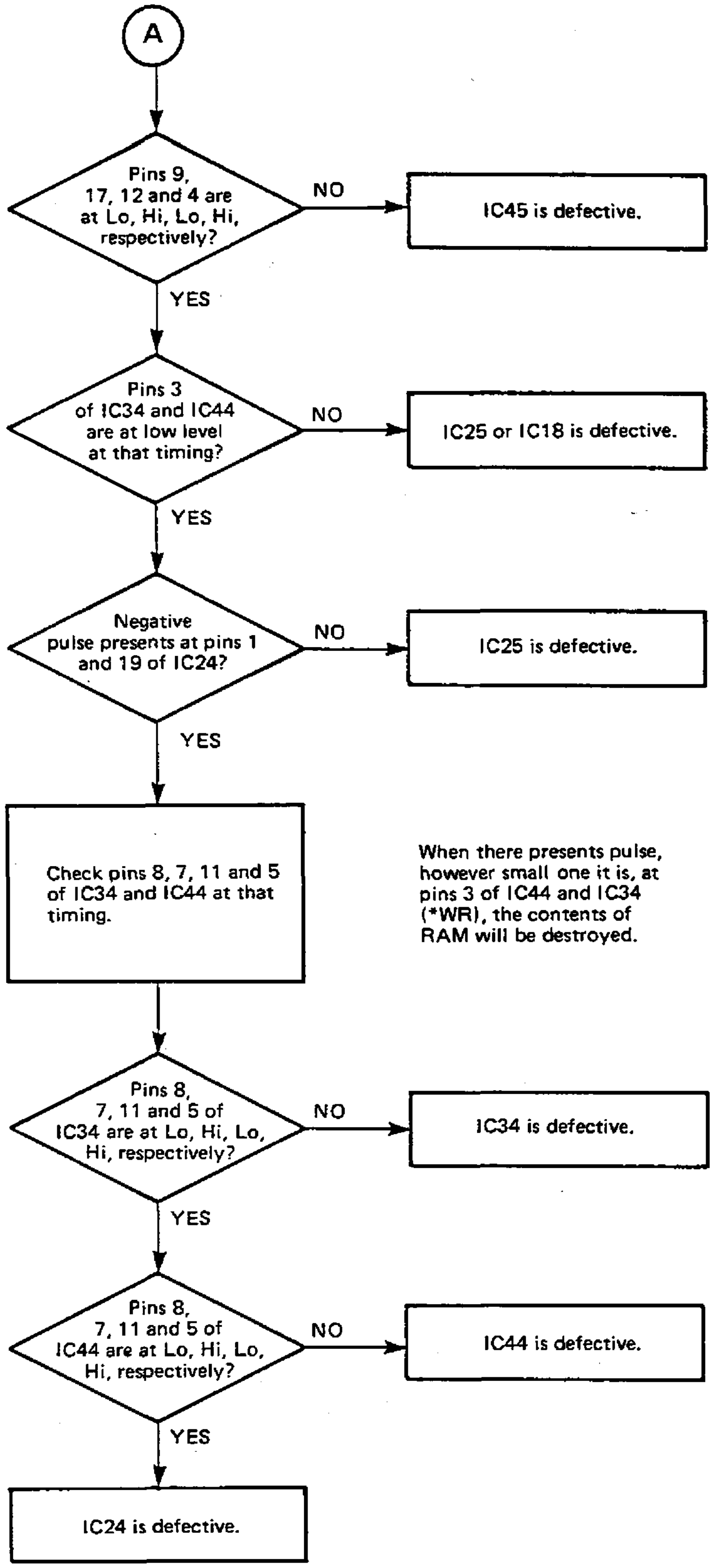

A
Pins 9, 17, 12 and 4 are at Lo, Hi, Lo, Hi, respectively?
NO
IC45 is defective.
YES
Pins 3 of IC34 and IC44 are at low level at that timing?
NO
IC25 or IC18 is defective.
YES
Negative pulse presents at pins 1 and 19 of IC24?
NO
IC25 is defective.
YES
Check pins 8, 7, 11 and 5 of IC34 and IC44 at that timing.
When there presents pulse, however small one it is, at pins 3 of IC44 and IC34 (*WR), the contents of RAM will be destroyed.
Pins 8, 7, 11 and 5 of IC34 are at Lo, Hi, Lo, Hi, respectively?
NO
IC34 is defective.
YES
Pins 8, 7, 11 and 5 of IC44 are at Lo, Hi, Lo, Hi, respectively?
NO
IC44 is defective.
YES
IC24 is defective.

CHART 21 *CSJOB

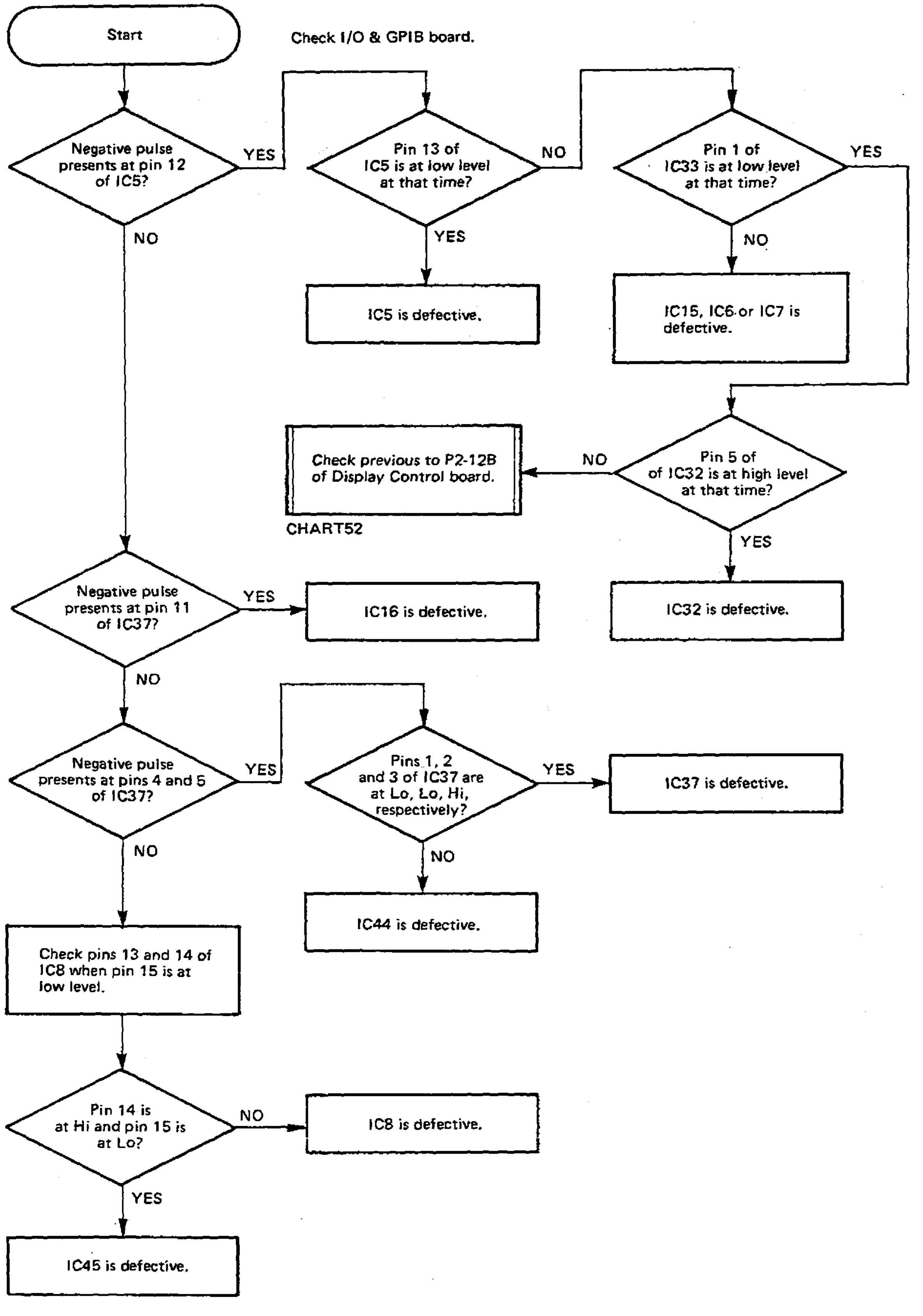


CHART 22 *WR2

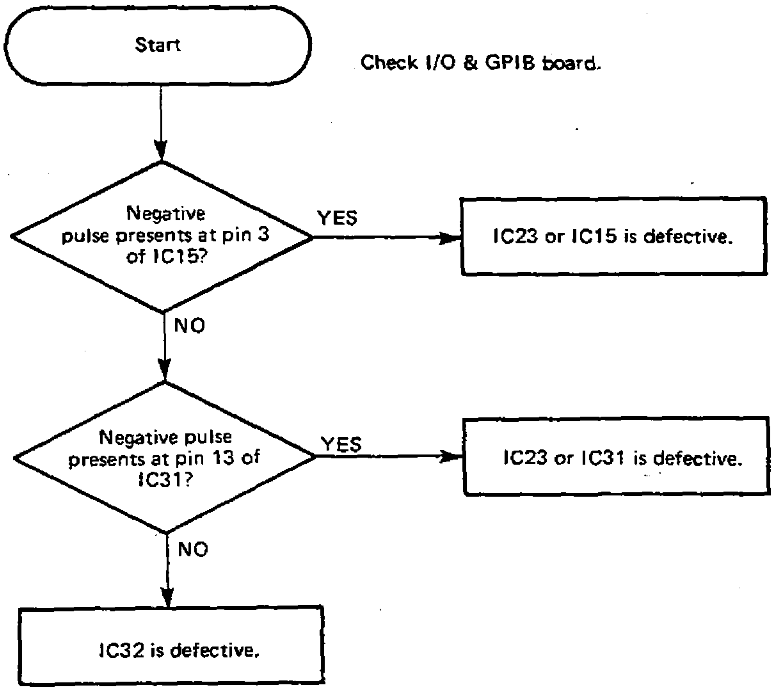

Start
Check I/O & GPIB board.
Negative pulse presents at pin 3 of IC15?
YES
IC23 or IC15 is defective.
NO
Negative pulse presents at pin 13 of IC31?
YES
IC23 or IC31 is defective.
NO
IC32 is defective.

CHART 23 Display Control RAM Address

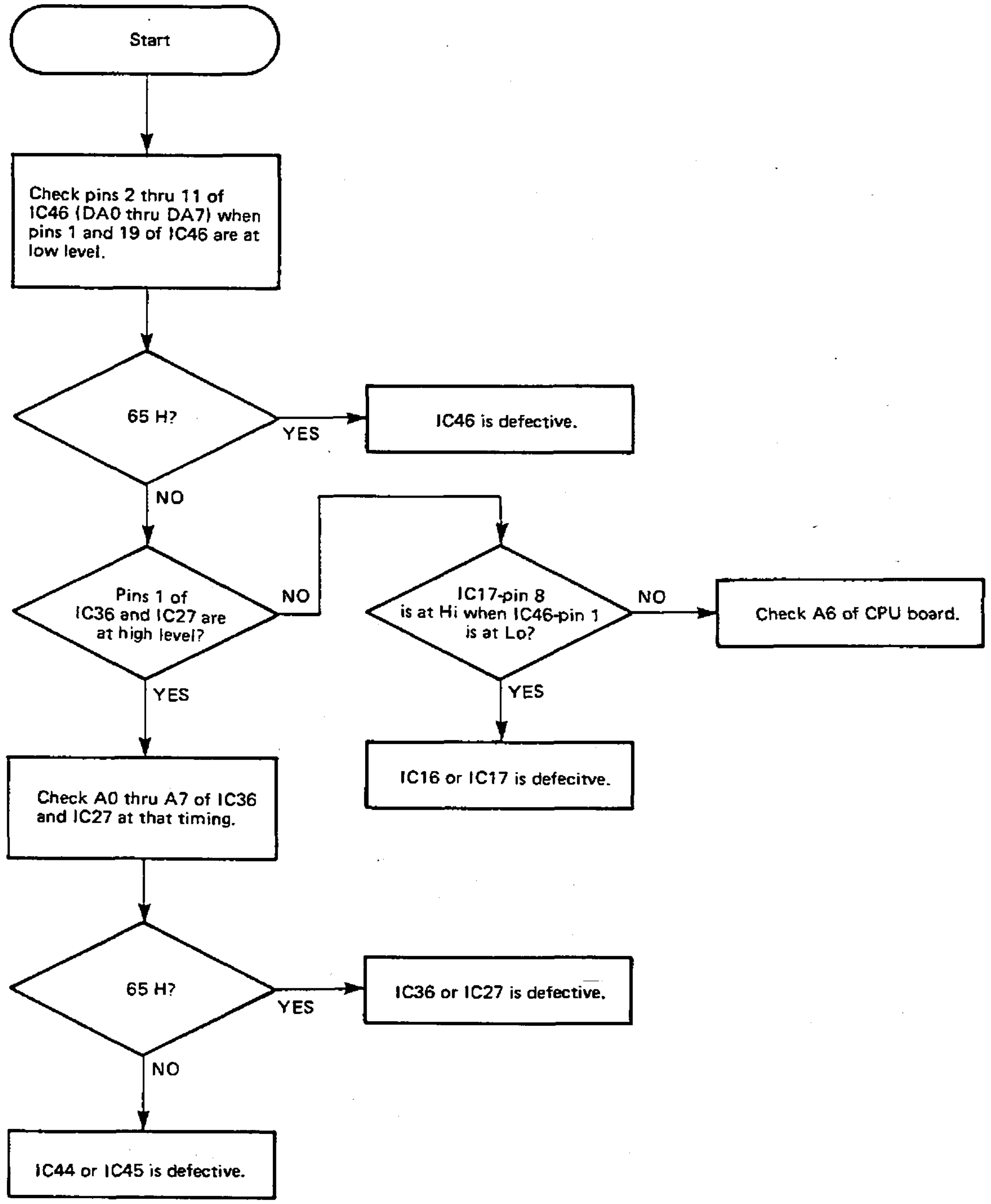
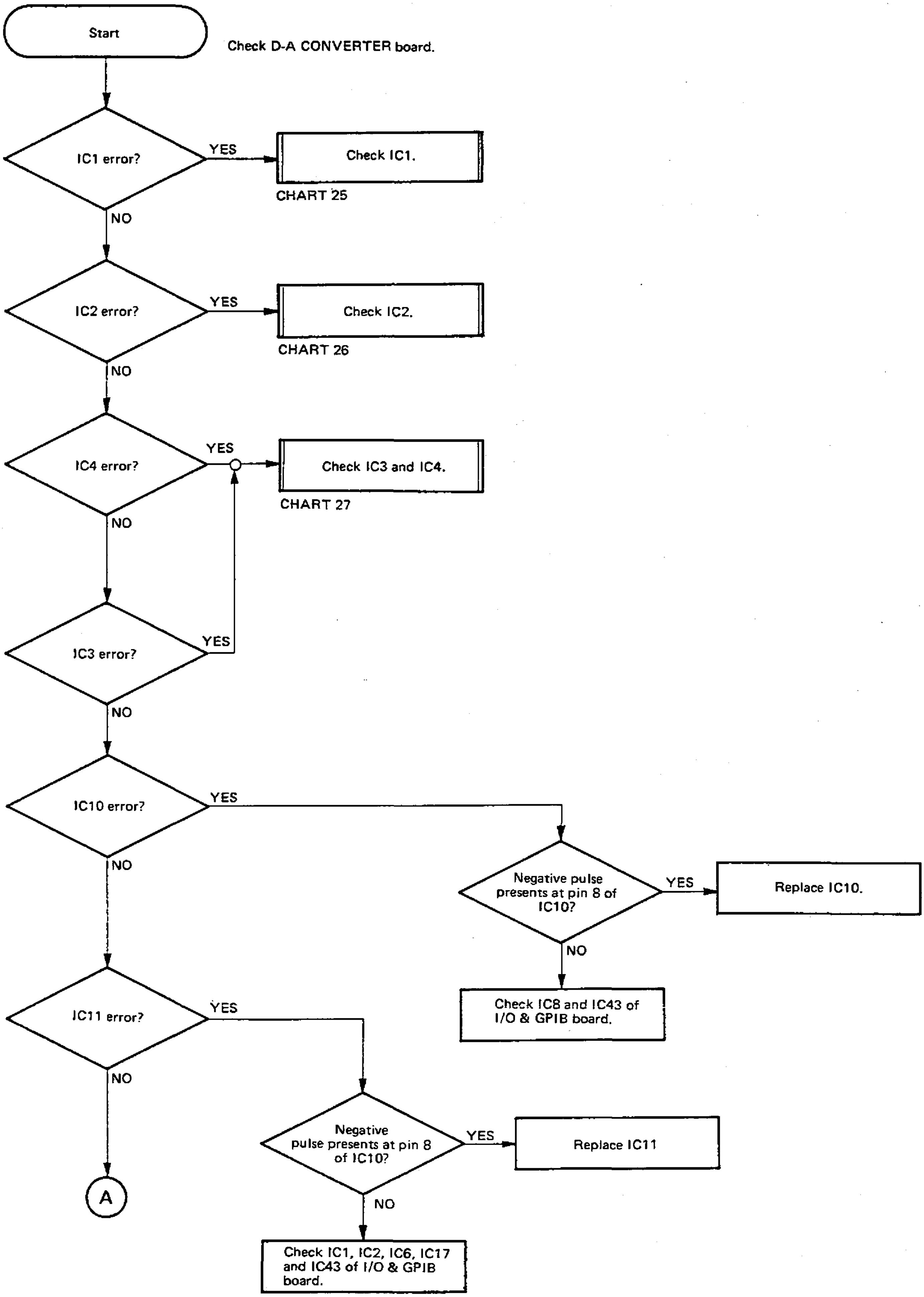


CHART 24 D-A RAM



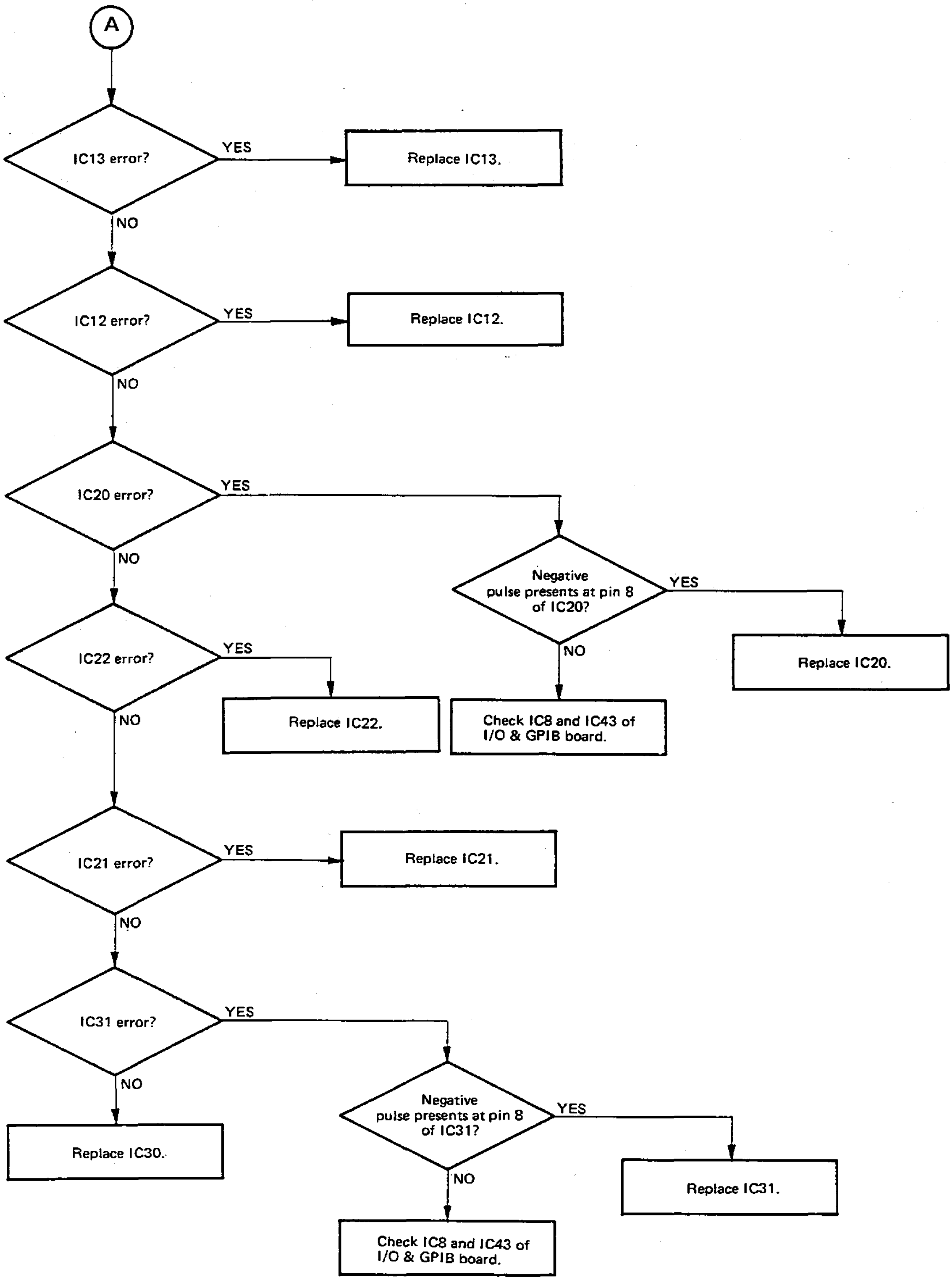
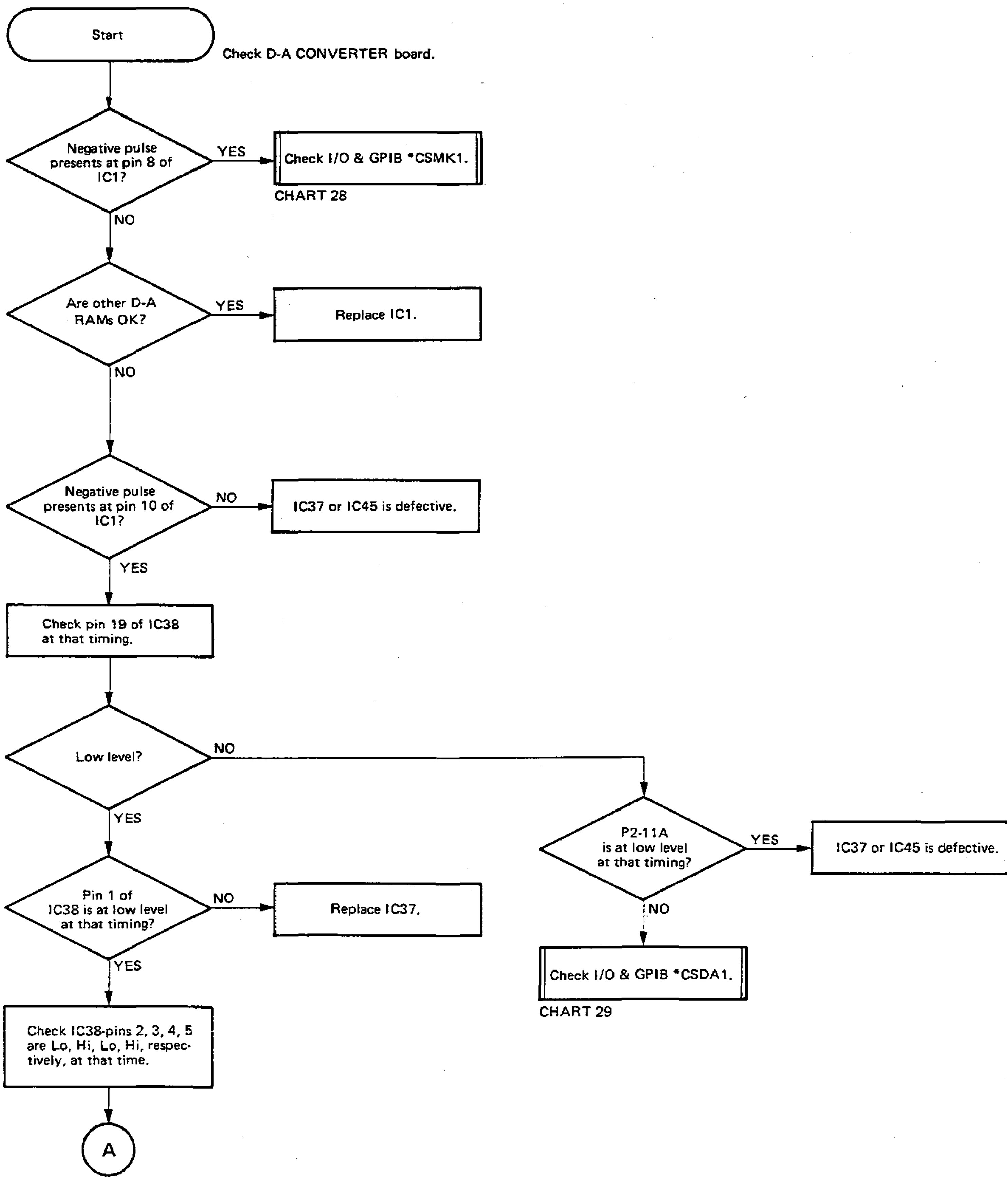

A
IC13 error?
YES
Replace IC13.
NO
IC12 error?
YES
Replace IC12.
NO
IC20 error?
YES
Negative pulse presents at pin 8 of IC20?
YES
Replace IC20.
NO
Check IC8 and IC43 of I/O & GPIB board.
NO
IC22 error?
YES
Replace IC22.
NO
IC21 error?
YES
Replace IC21.
NO
IC31 error?
YES
Negative pulse presents at pin 8 of IC31?
YES
Replace IC31.
NO
Check IC8 and IC43 of I/O & GPIB board.
NO
Replace IC30.

CHART 25 D-A Converter IC1



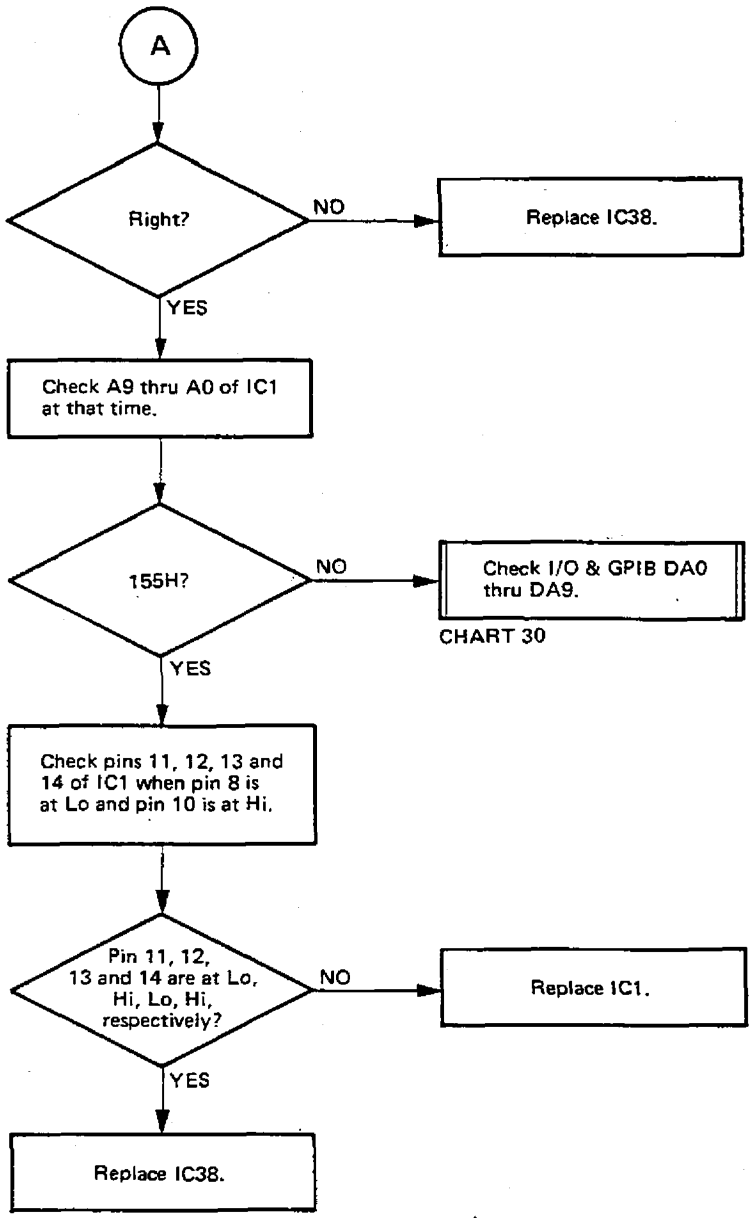

A
Right?
NO
Replace IC38.
YES
Check A9 thru A0 of IC1 at that time.
155H?
NO
Check I/O & GPIB DA0 thru DA9.
CHART 30
YES
Check pins 11, 12, 13 and 14 of IC1 when pin 8 is at Lo and pin 10 is at Hi.
Pin 11, 12, 13 and 14 are at Lo, Hi, Lo, Hi, respectively?
NO
Replace IC1.
YES
Replace IC38.

CHART 26 D-A Converter IC2

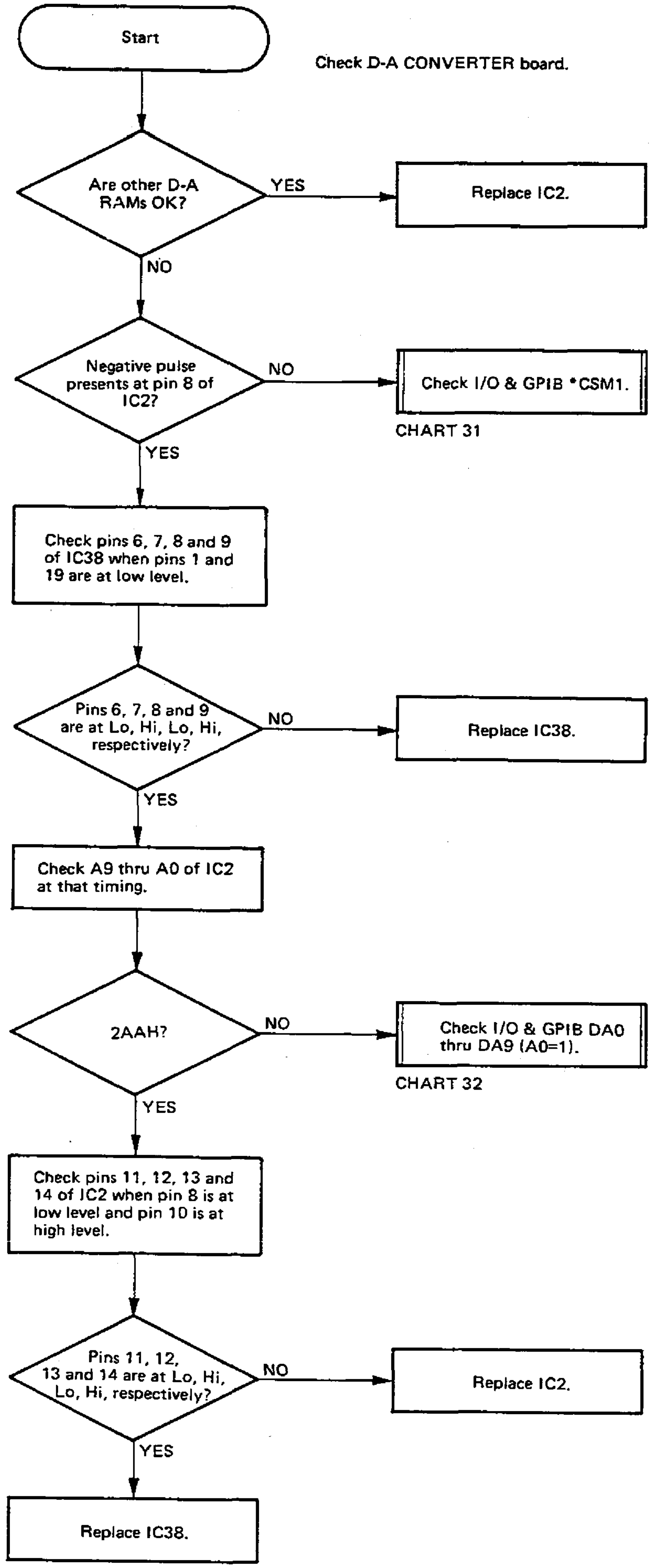


CHART 27 D-A Converter IC3, IC4

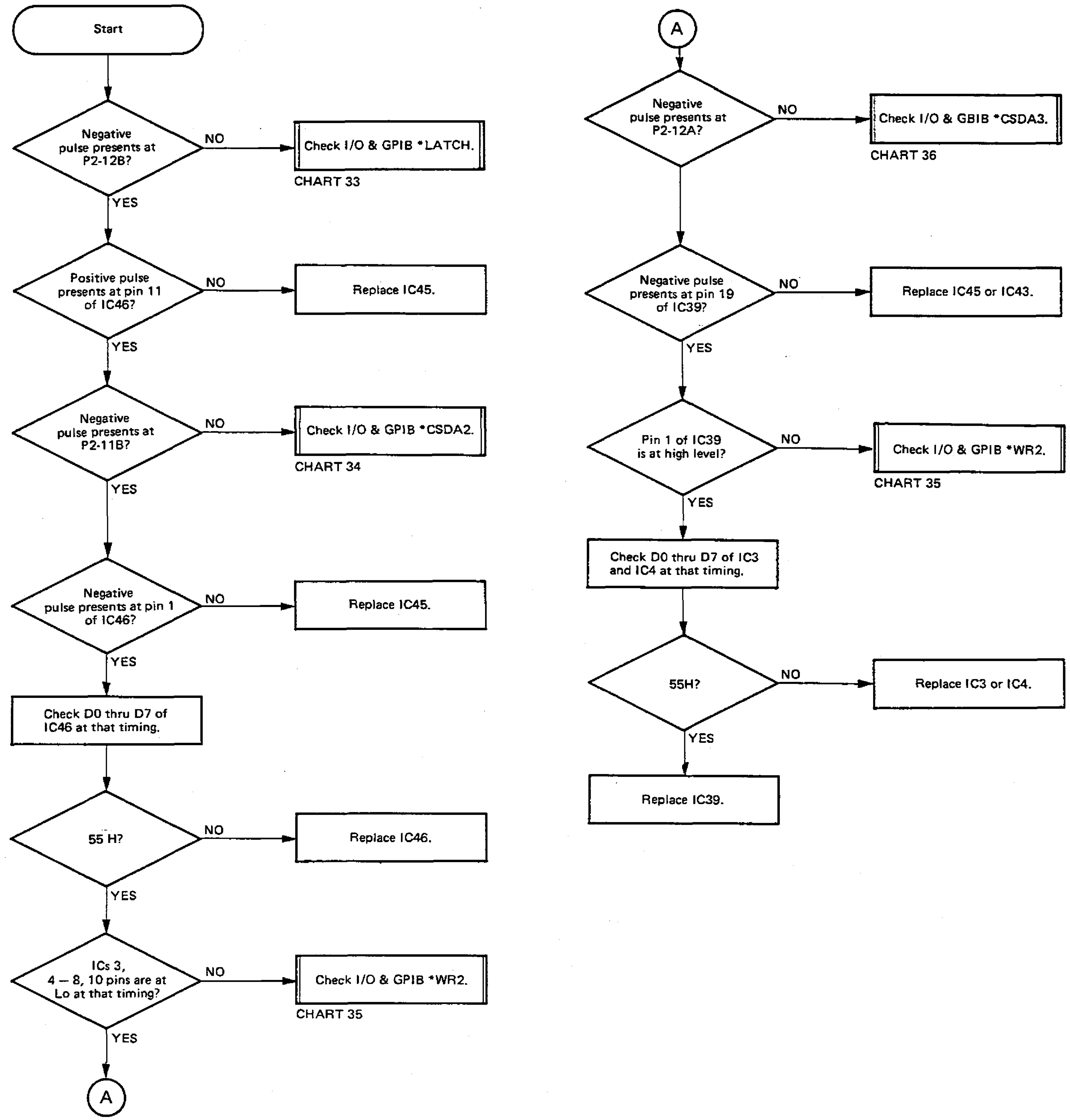
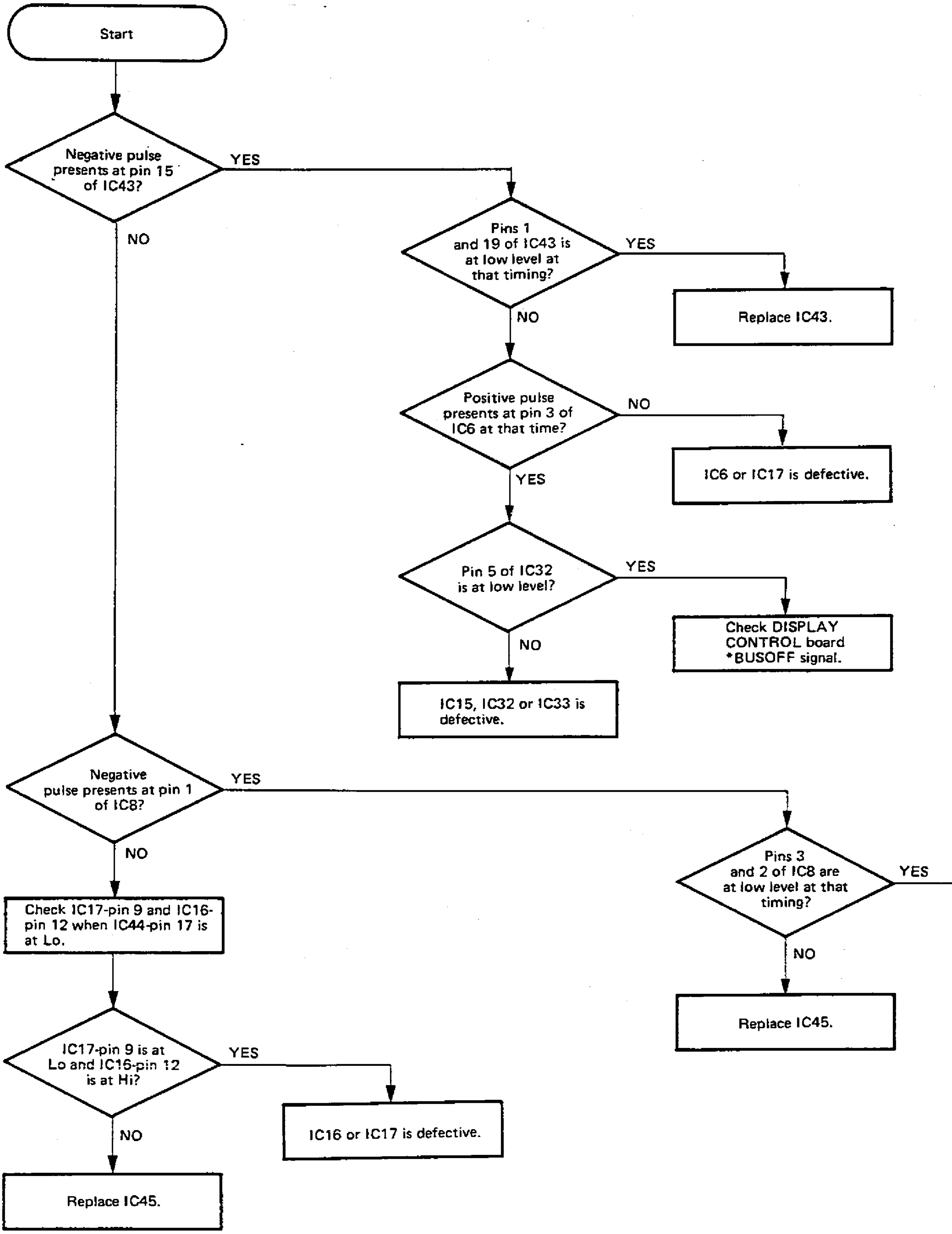


CHART 28 I/O & GPIB *CSMK1



Replace IC8.

CHART 29 I/O & GPIB *CSDA1

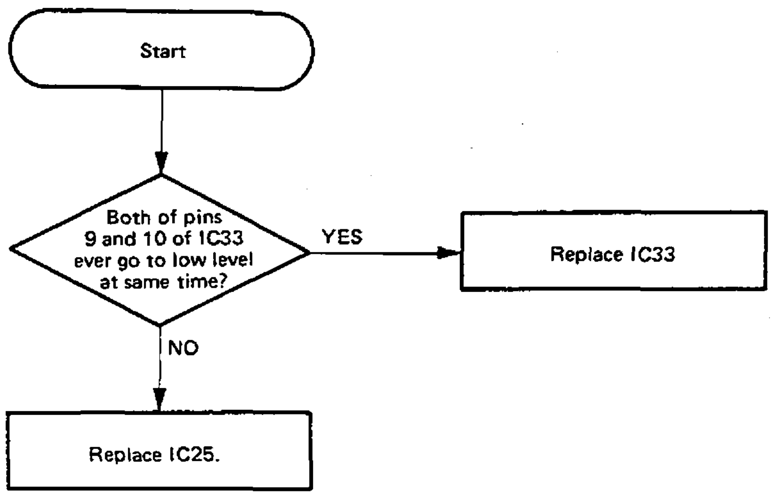


CHART 30 I/O & GPIB DA0 thru DA9

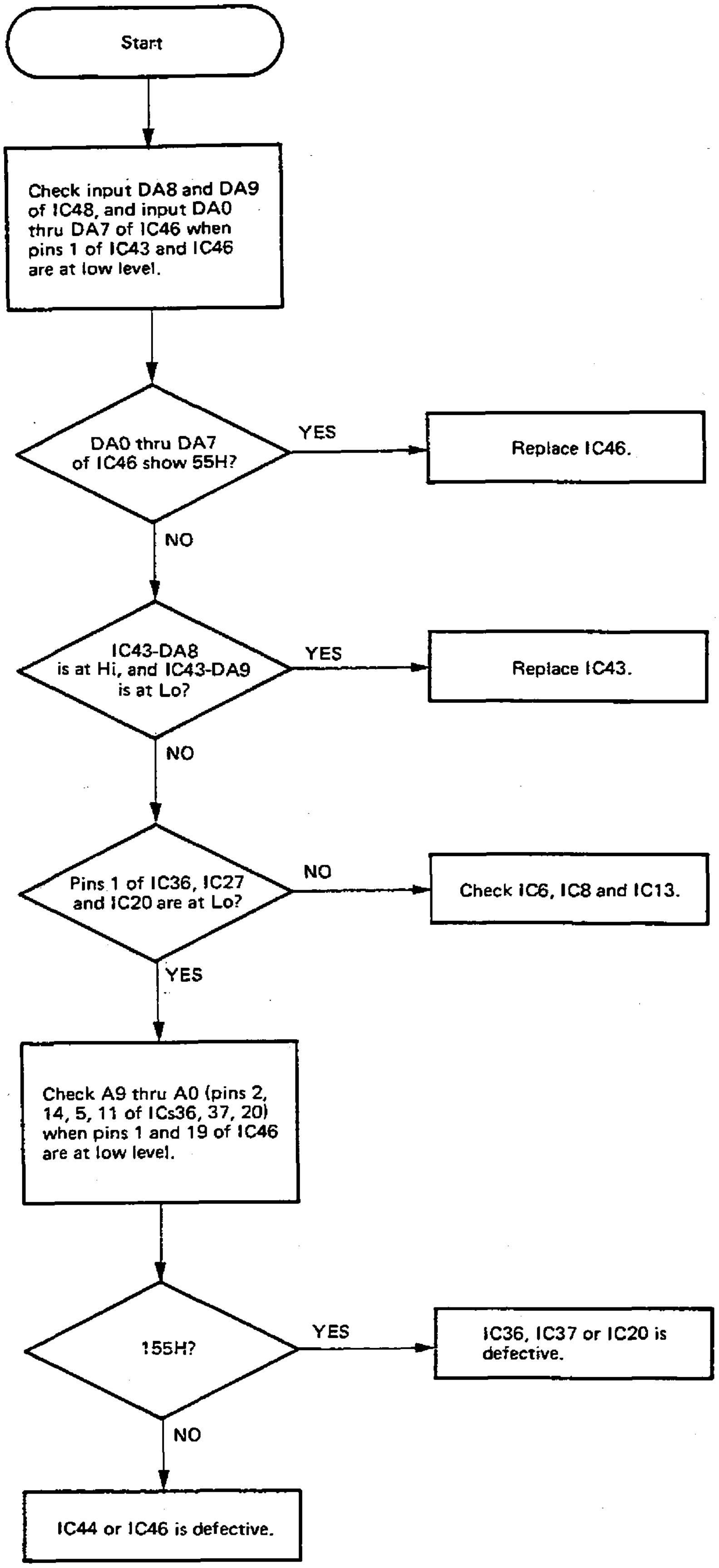


CHART 31 I/O & GPIB *CSM1

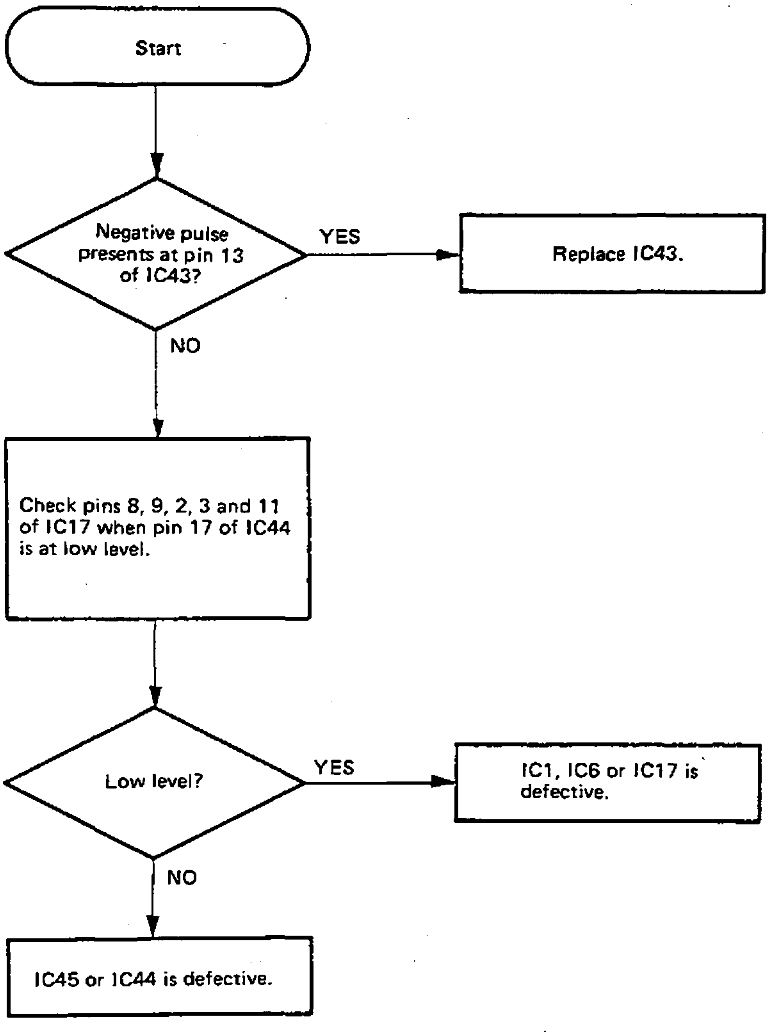


CHART 32 I/O & GPIB DA0 thru DA9 (A0 = 1)

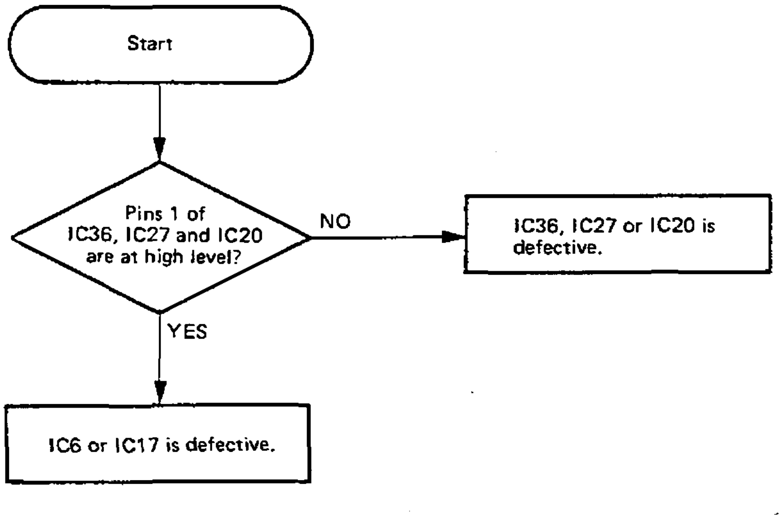


CHART 33 I/O & GPIB *LATCH

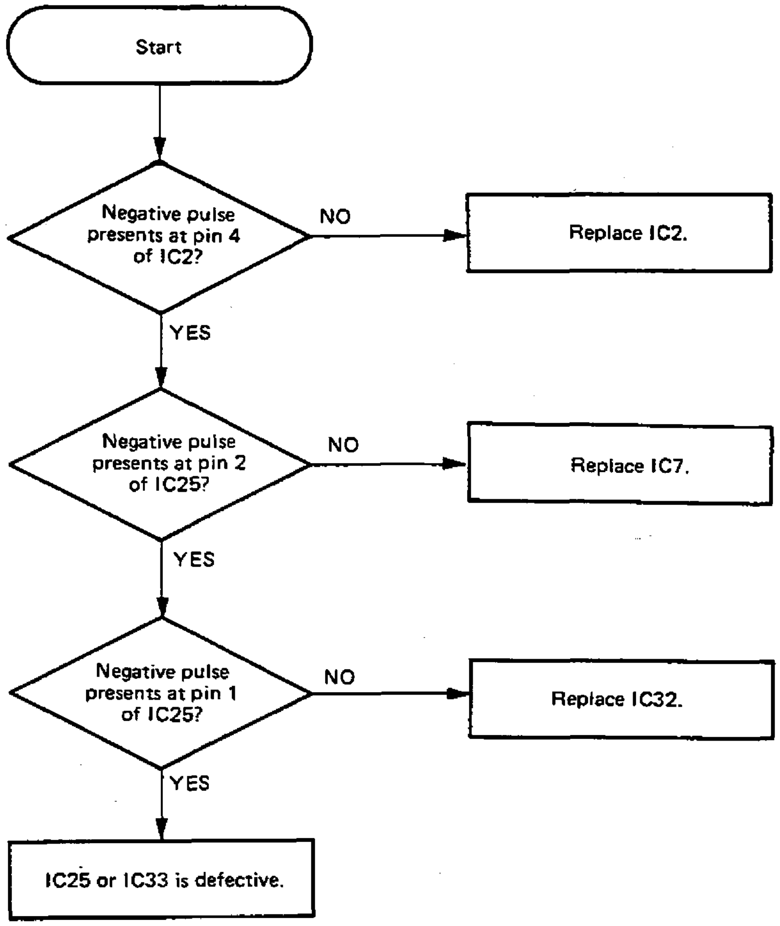


CHART 34 I/O & GPIB *CSDA2

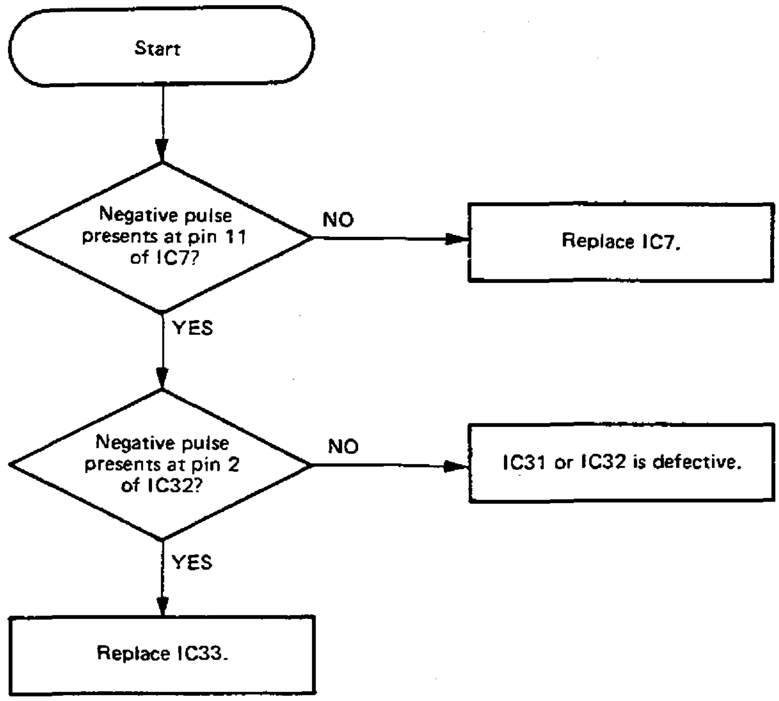


CHART 35 I/O & GPIB *WR2

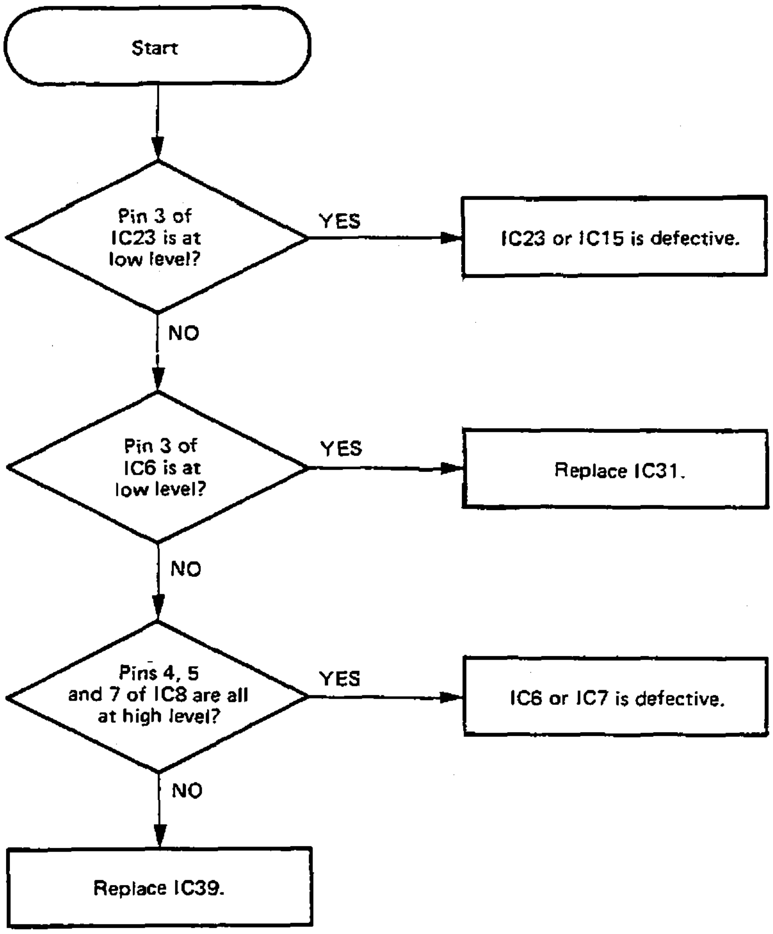
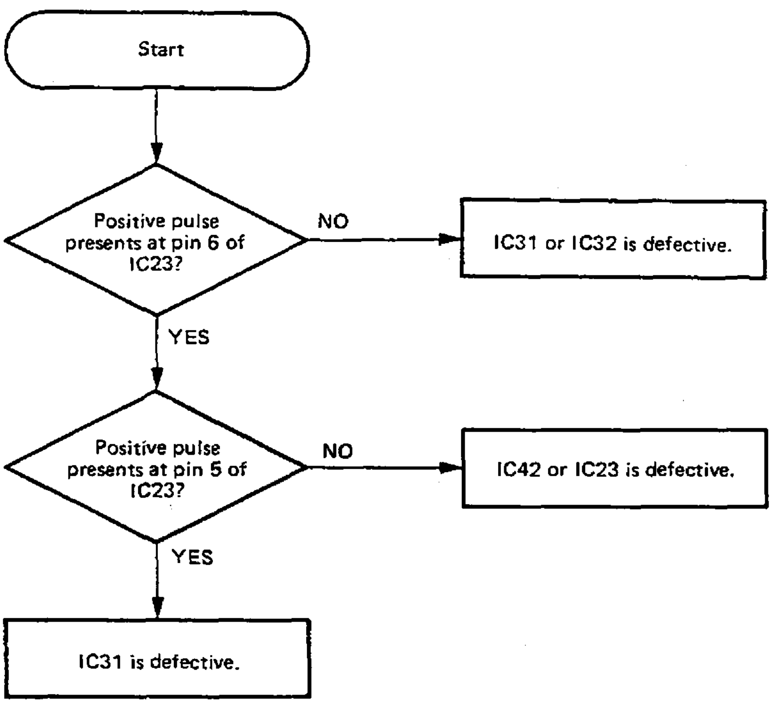


CHART 36 I/O *GPIB *CSDA3



:HART 37 A/D Latch WR/RD

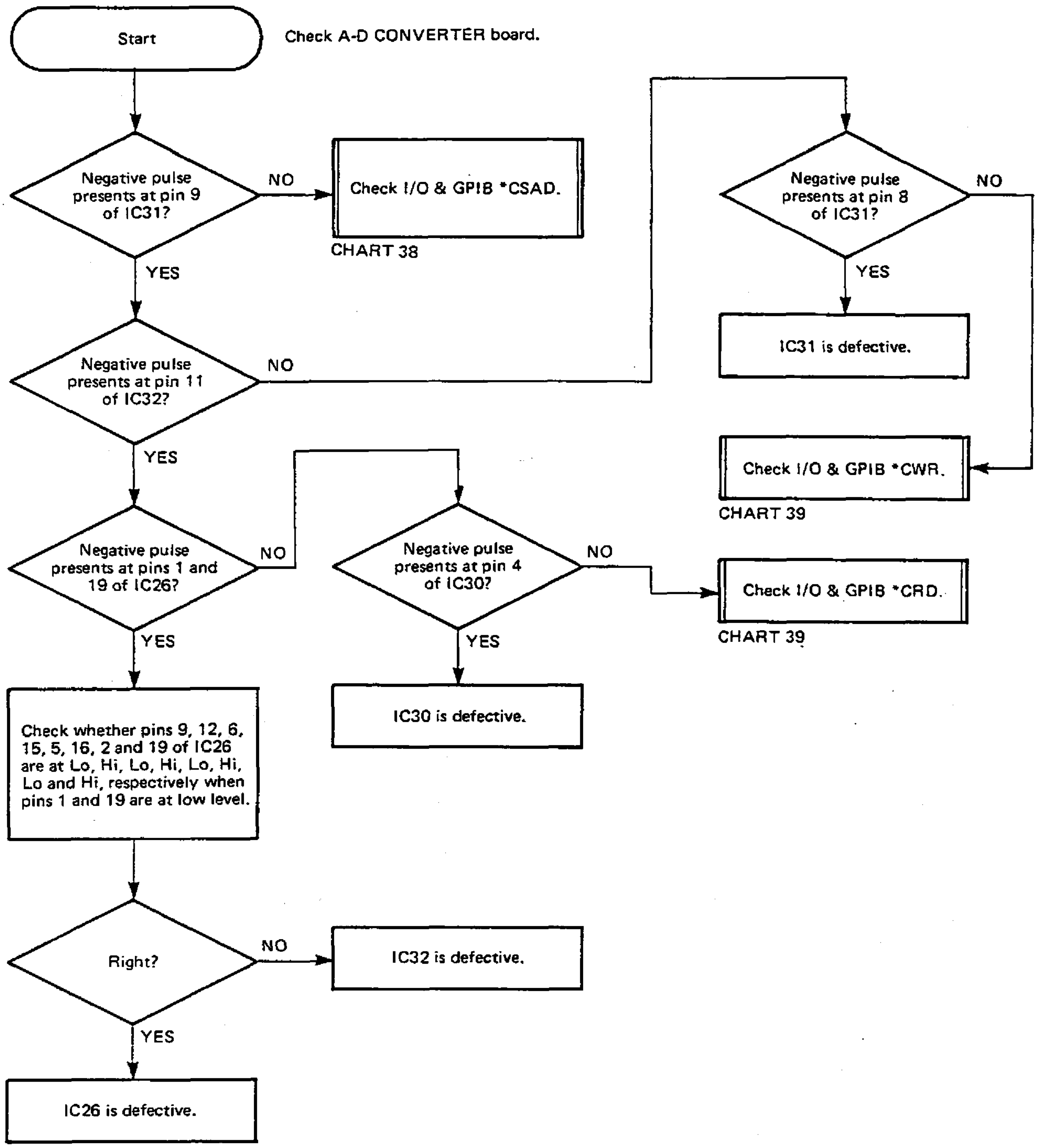


CHART 38 I/O & GPIB *CSAD

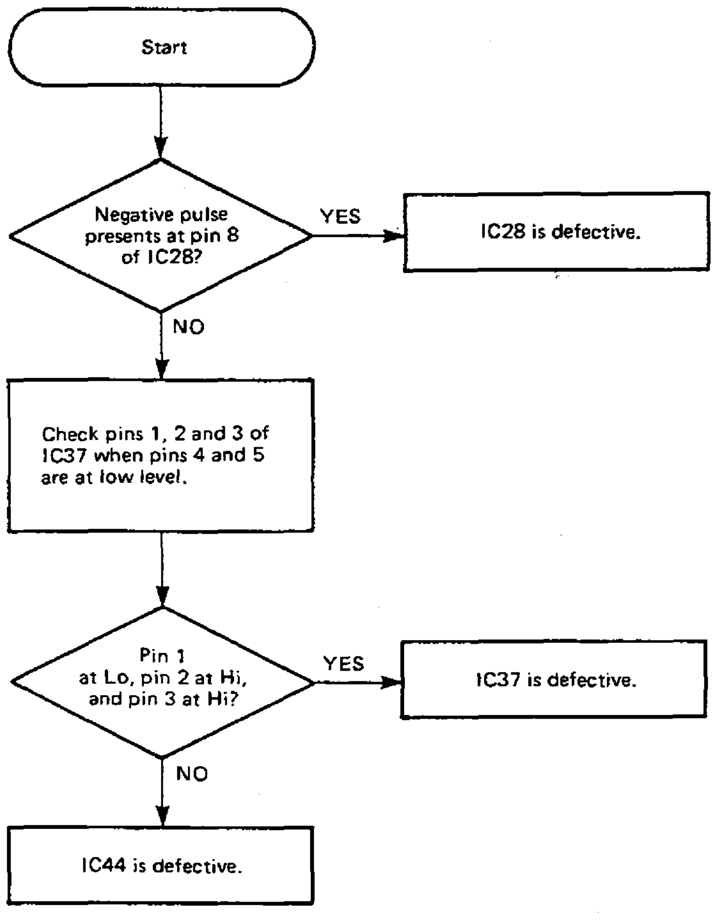


CHART 39 I/O & GPIB *CWR & *CRD

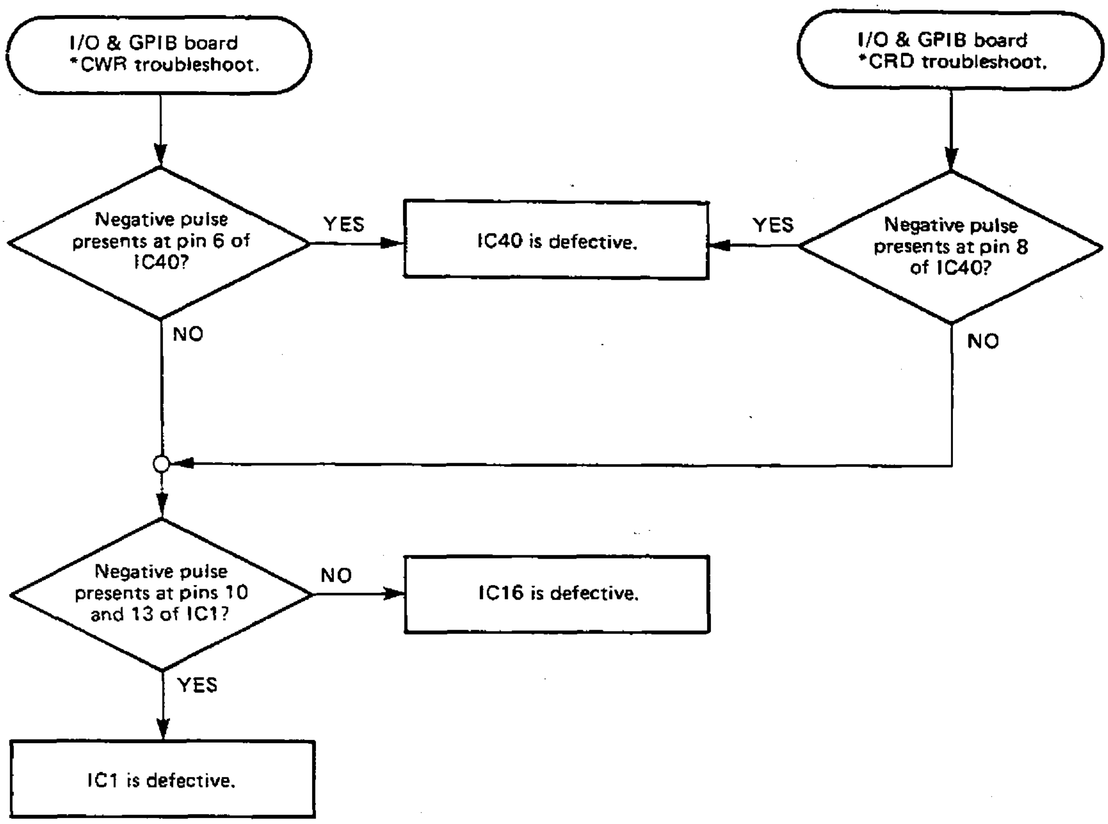
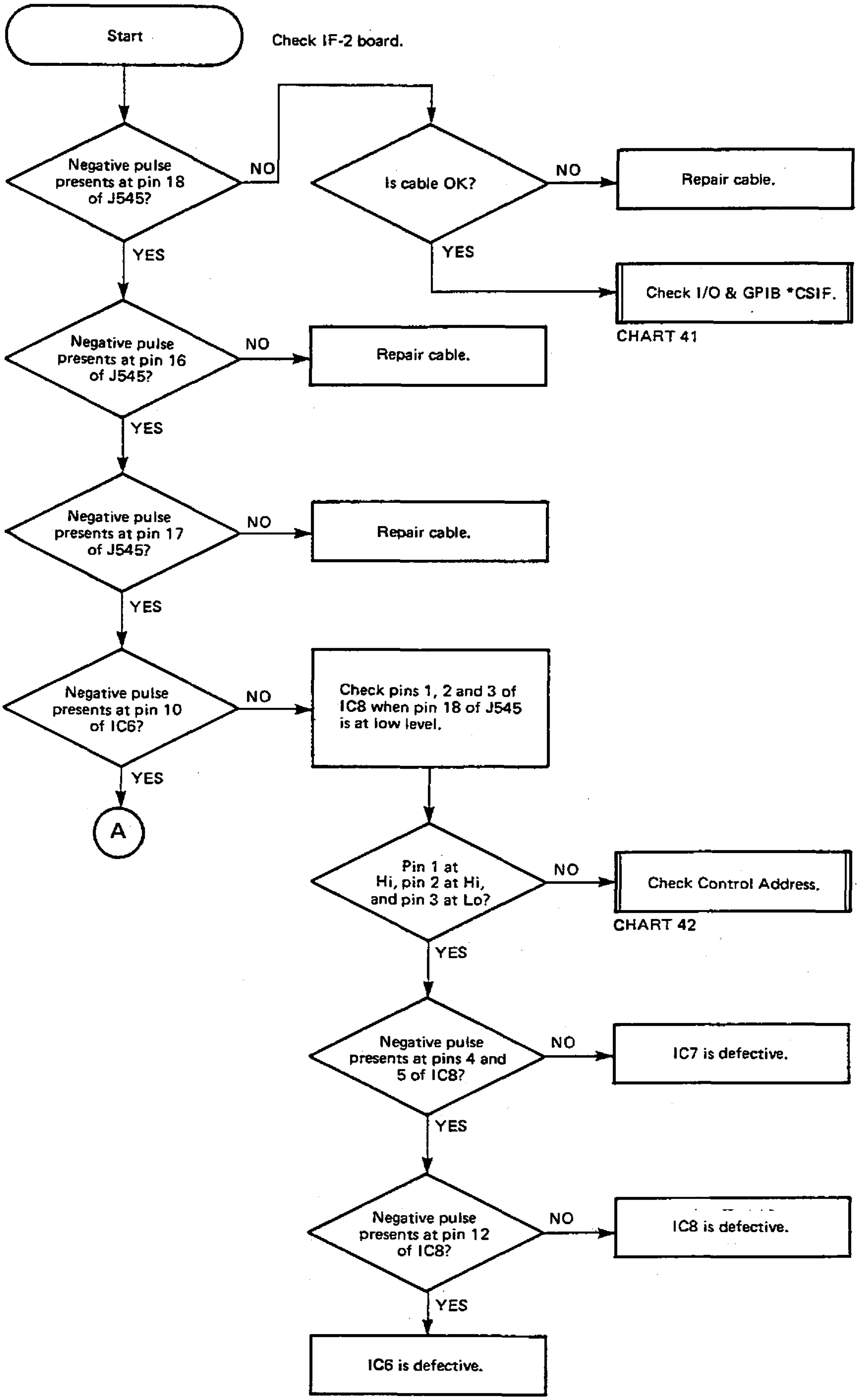


CHART 40 IF Latch WR/RD



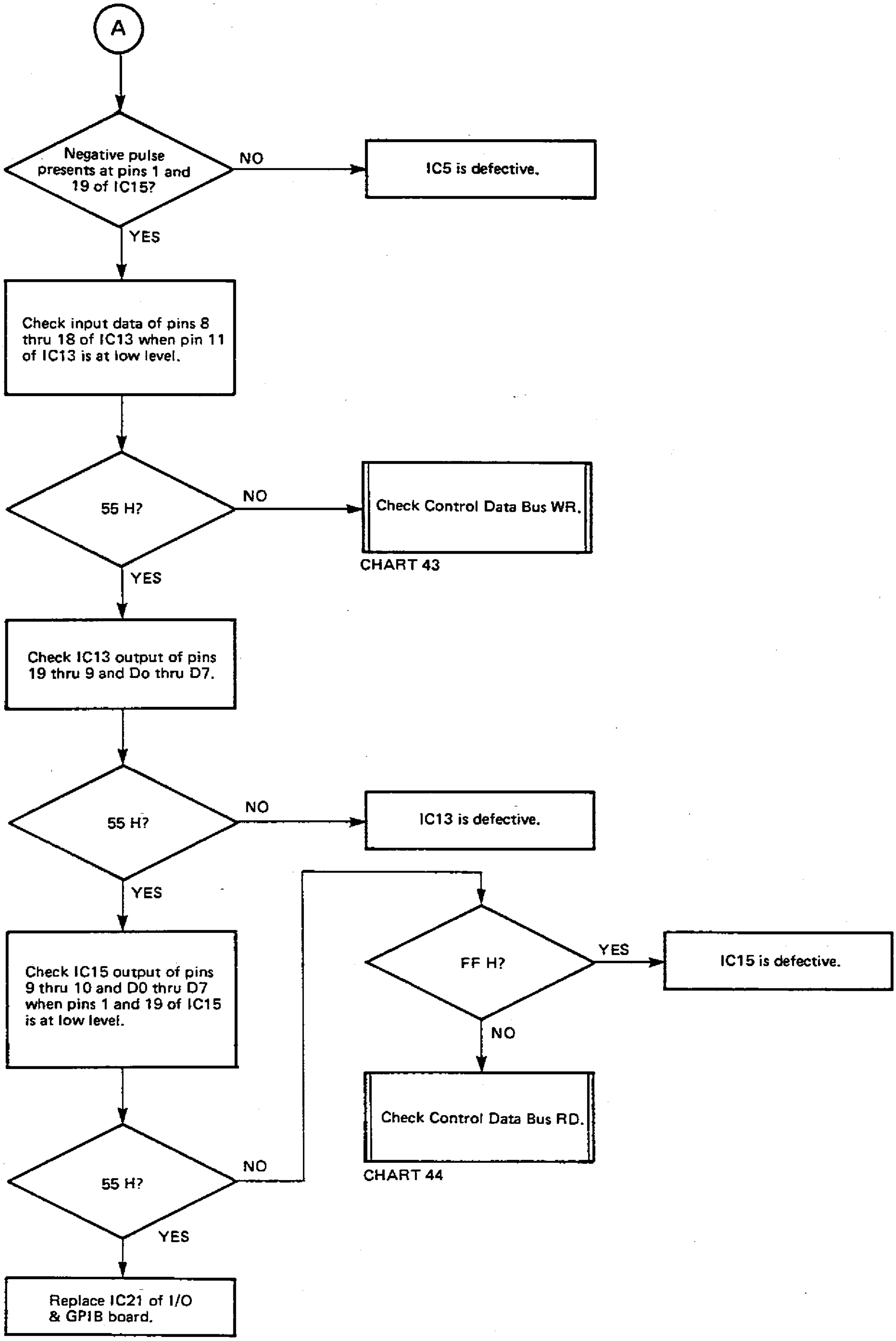

A
Negative pulse presents at pins 1 and 19 of IC15?
NO
IC5 is defective.
YES
Check input data of pins 8 thru 18 of IC13 when pin 11 of IC13 is at low level.
55 H?
NO
Check Control Data Bus WR.
CHART 43
YES
Check IC13 output of pins 19 thru 9 and Do thru D7.
55 H?
NO
IC13 is defective.
YES
Check IC15 output of pins 9 thru 10 and D0 thru D7 when pins 1 and 19 of IC15 is at low level.
55 H?
NO
FF H?
YES
IC15 is defective.
NO
Check Control Data Bus RD.
CHART 44
YES
Replace IC21 of I/O & GPIB board.

CHART 41 I/O & GPIB *CSIF

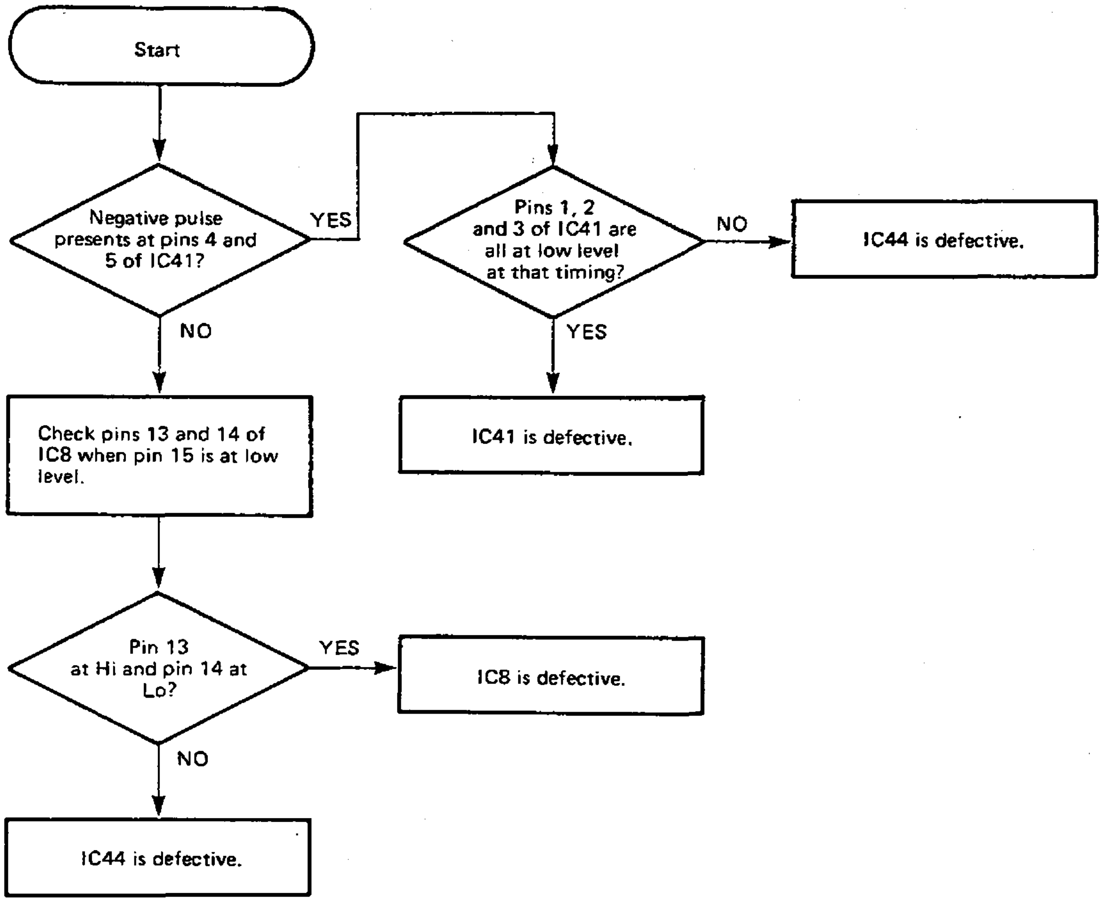


CHART 42 Control Address

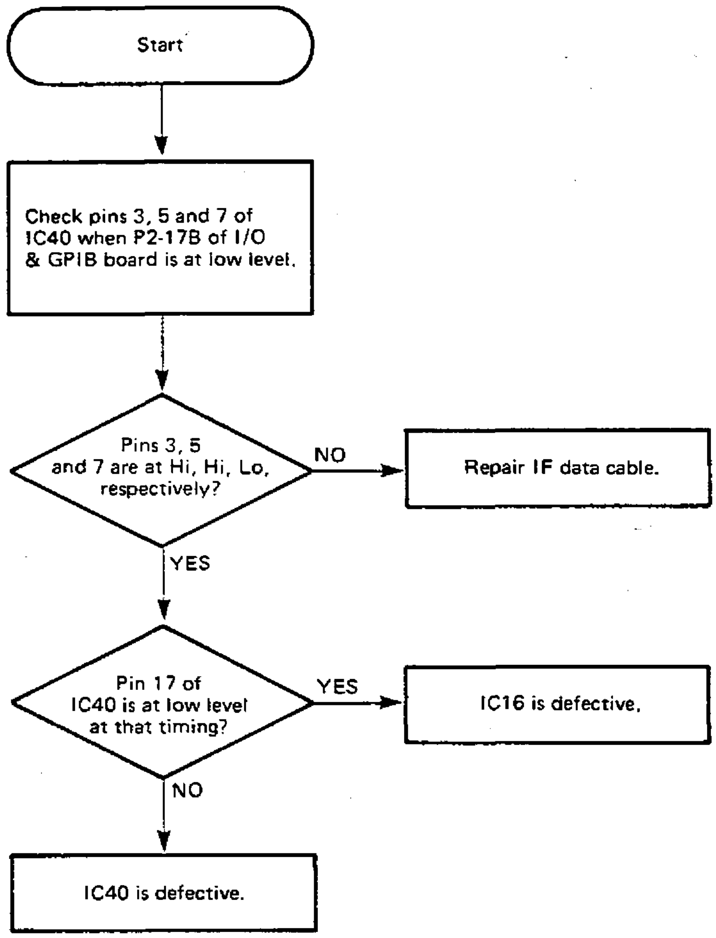


CHART 43 Control Data Bus WR

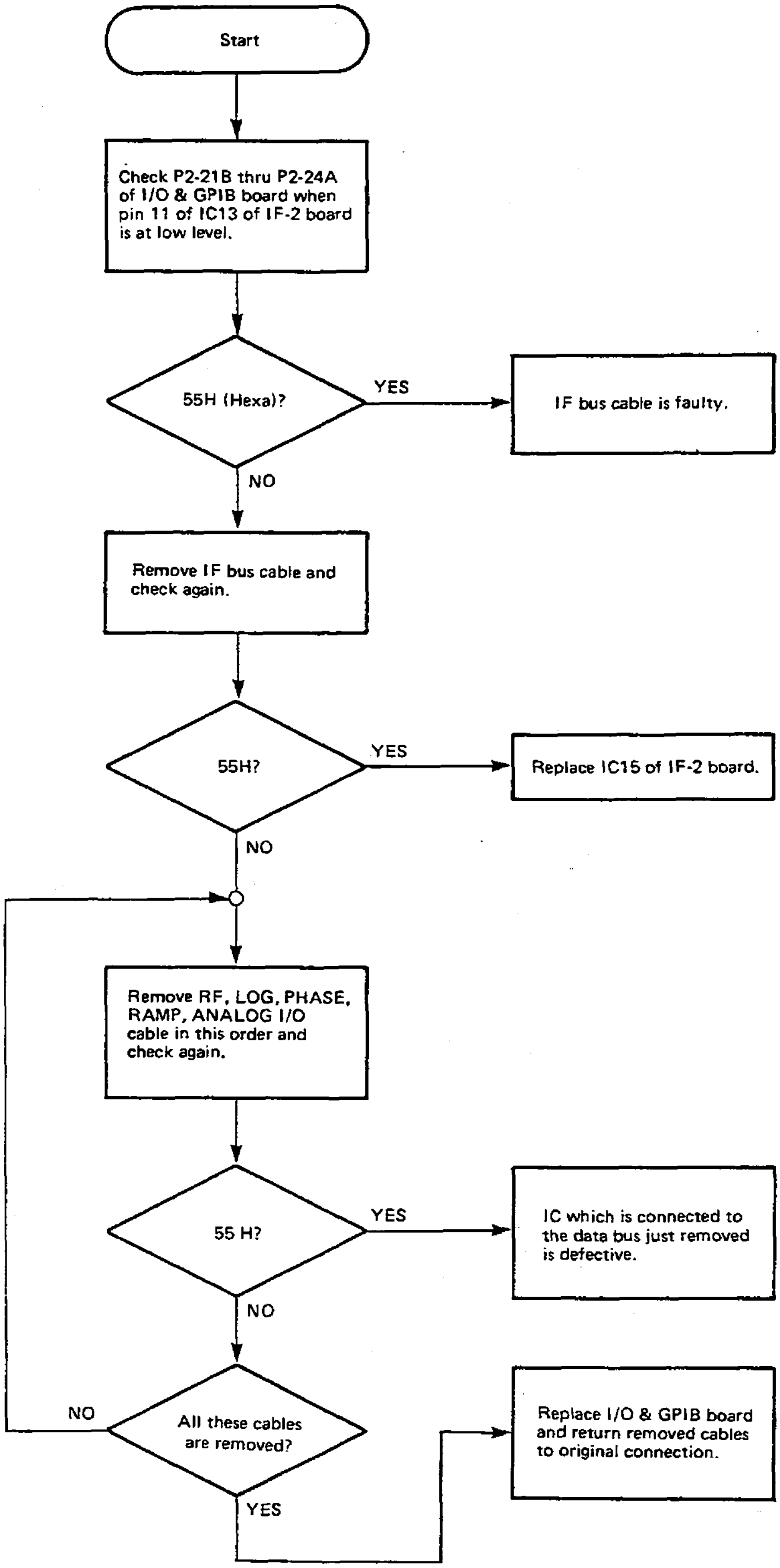


CHART 44 Control Data Bus RD

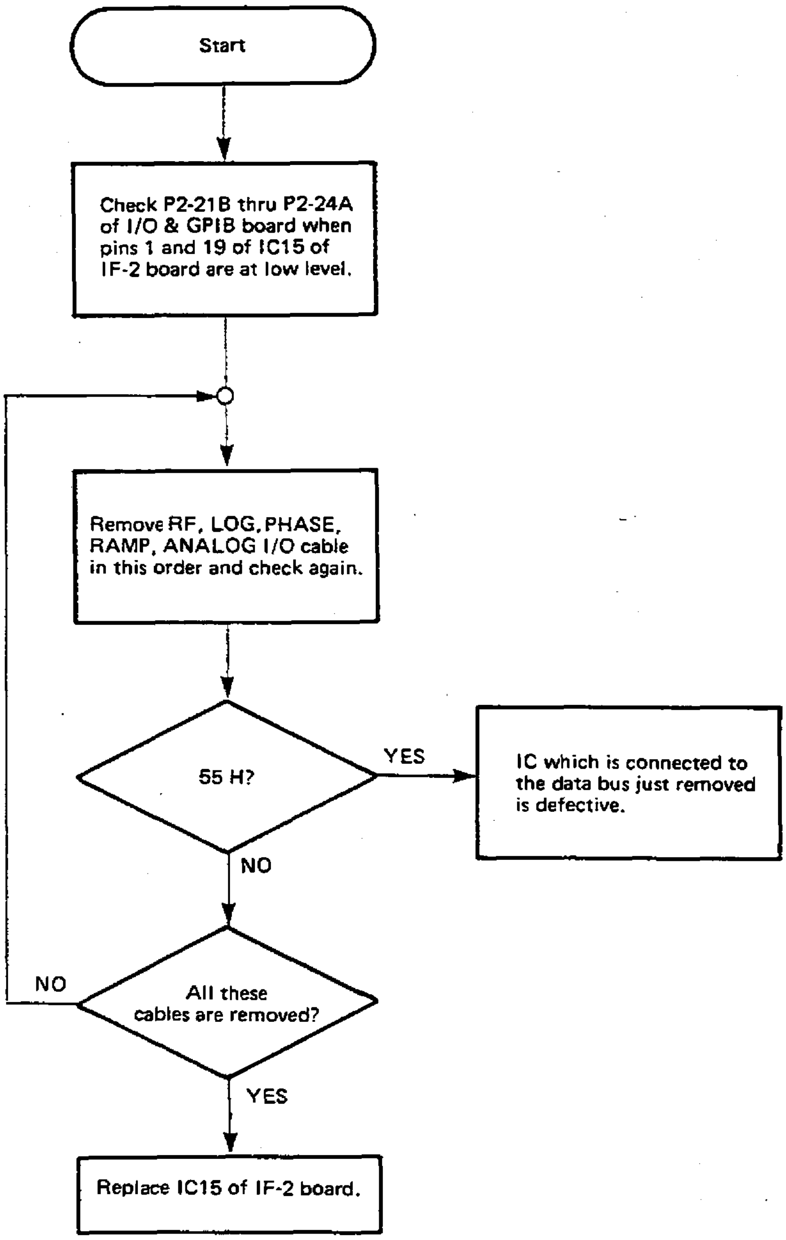
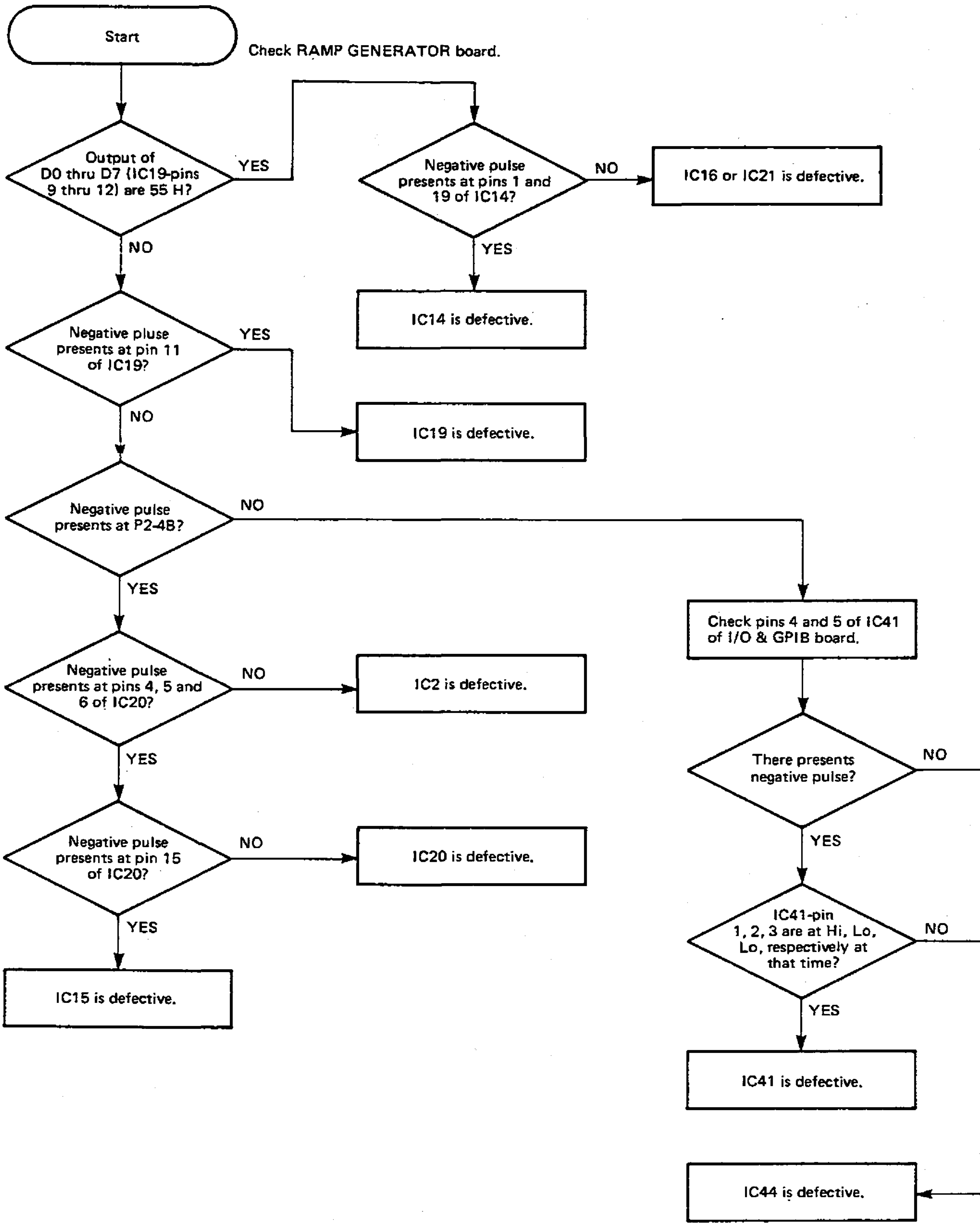


CHART 45 Ramp Latch WR/RD



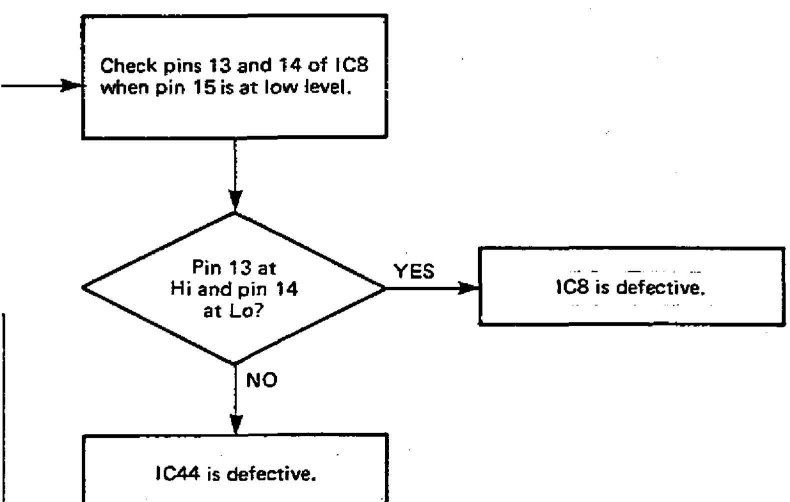

Check pins 13 and 14 of IC8 when pin 15 is at low level.
Pin 13 at Hi and pin 14 at Lo?
YES
IC8 is defective.
NO
IC44 is defective.

CHART 46 Att I/O Latch

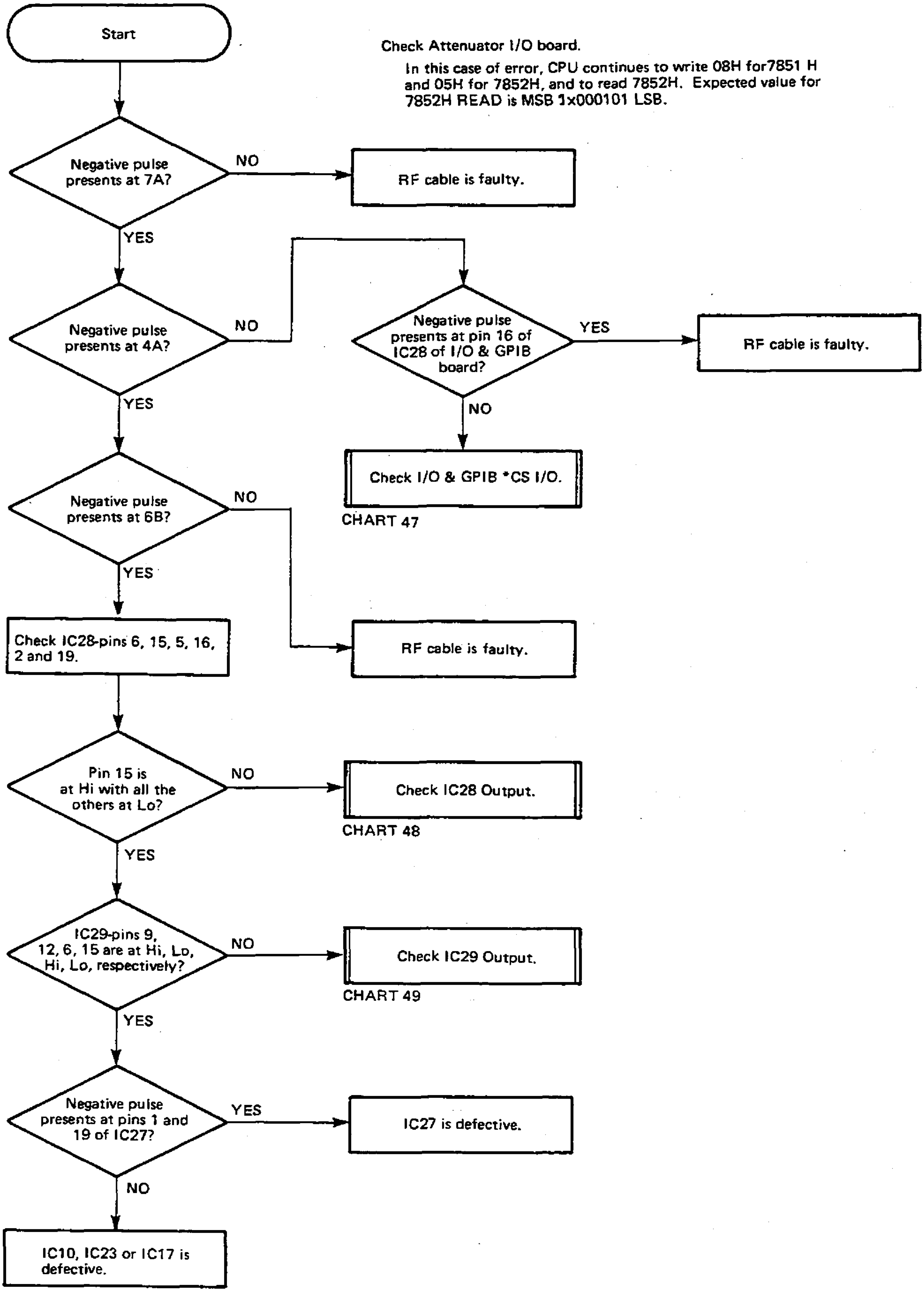


CHART 47 I/O & GPIB *CS I/O

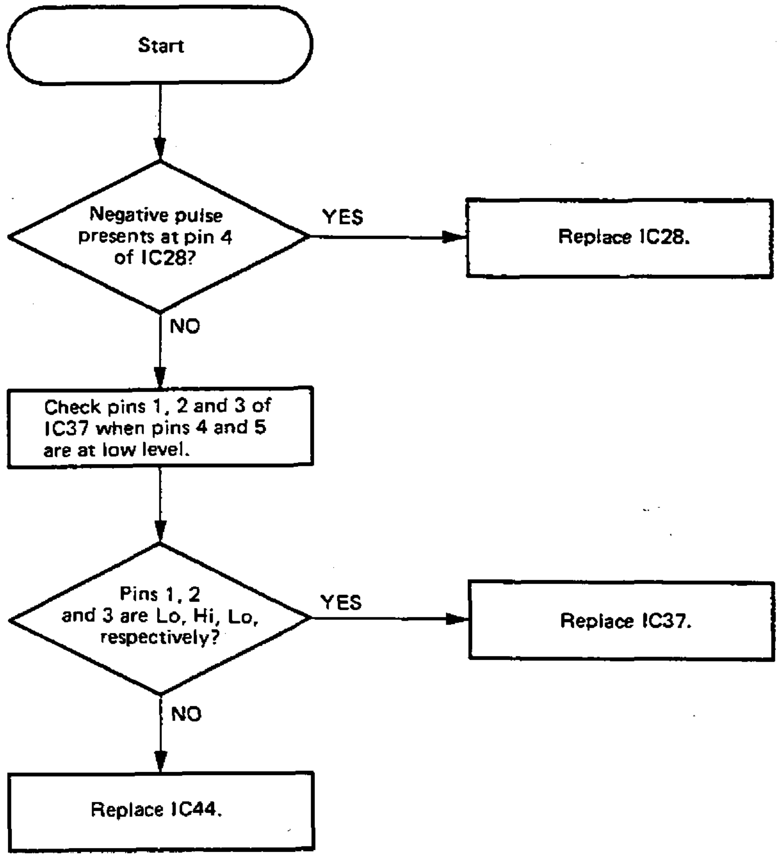


CHART 48 IC28 Output

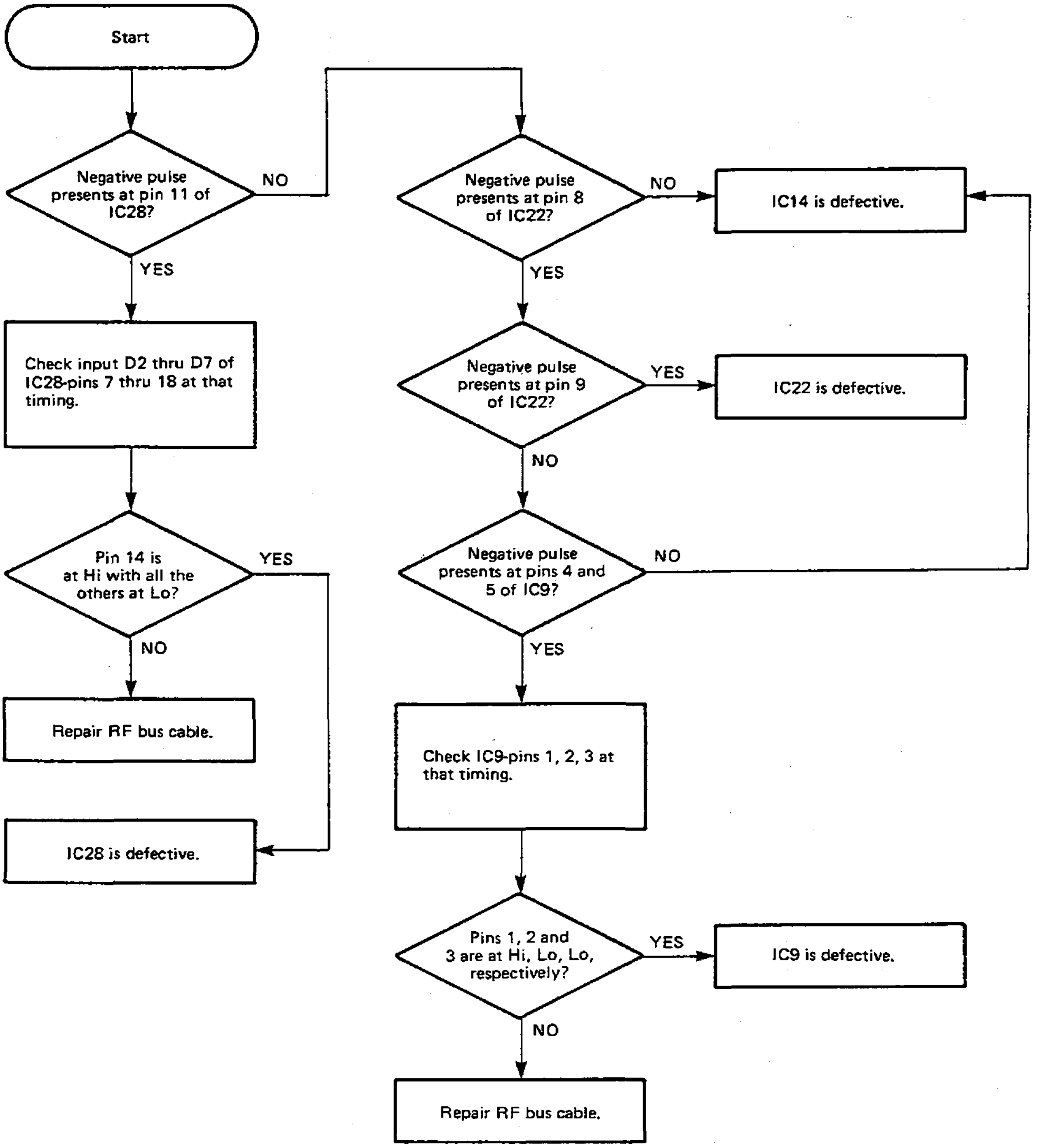


CHART 49 IC29 Output

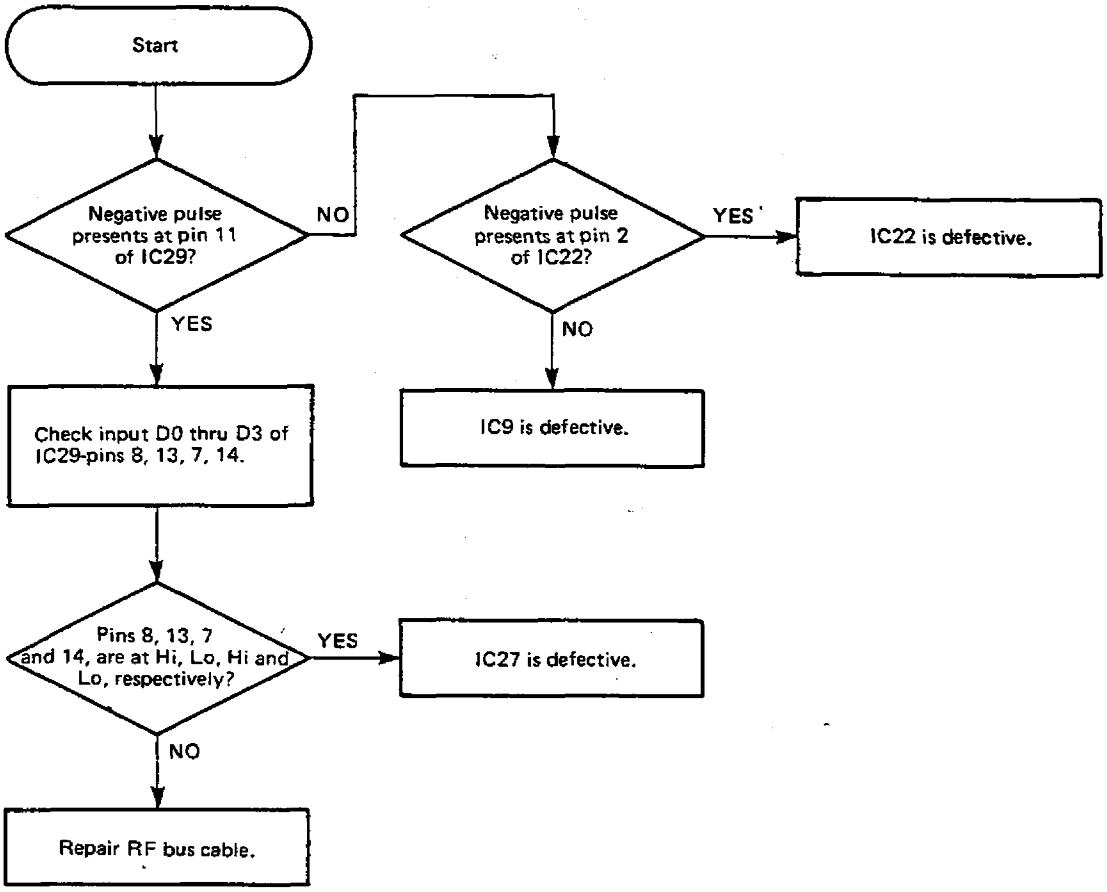
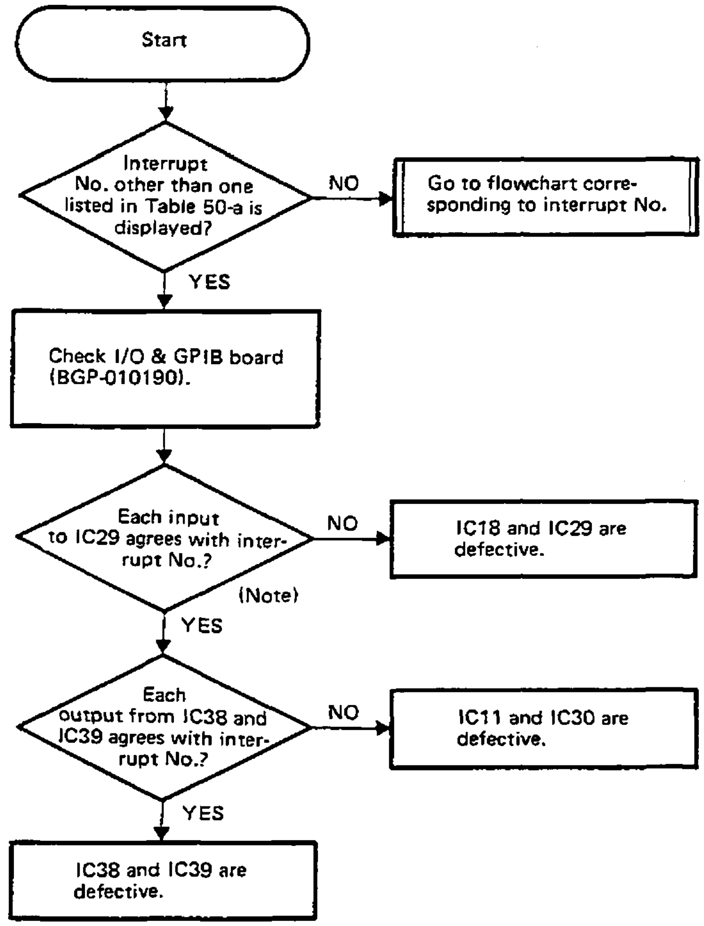
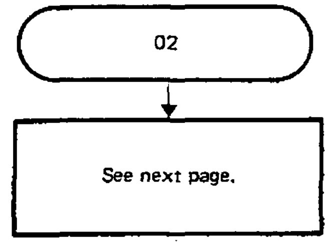
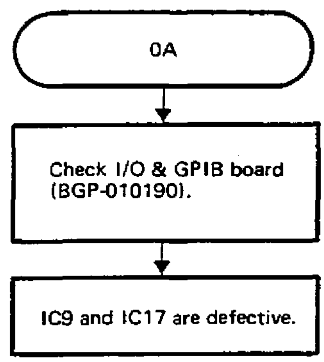


CHART 50 Interrupt



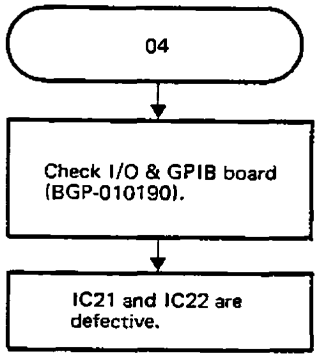


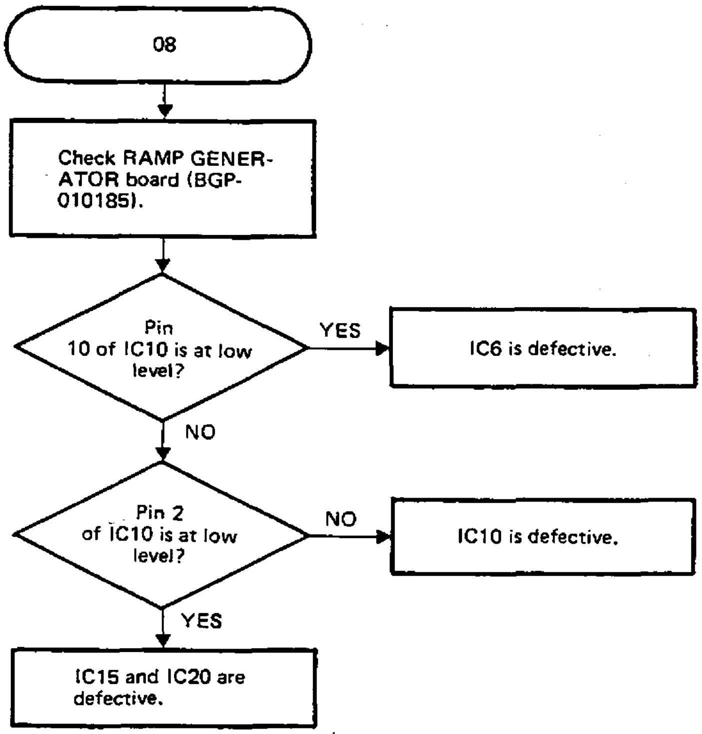


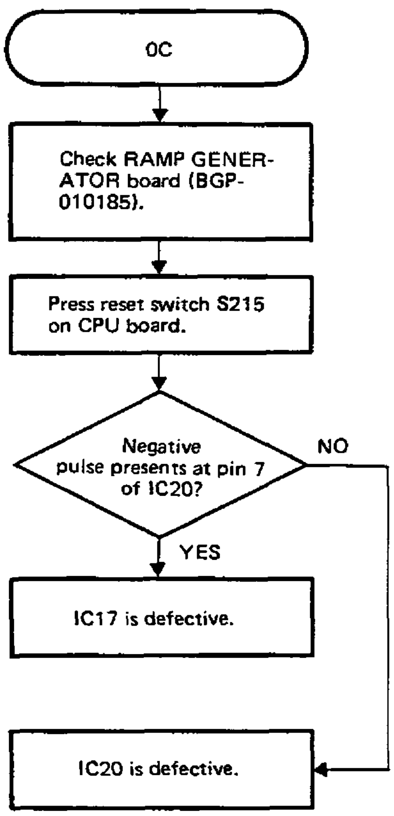
Note: For example, when $1E_H$ is the number, check if pins 14, 4, 12 and 6 of IC29 go high.

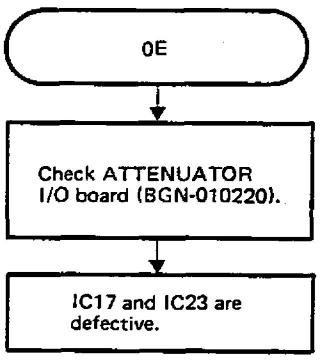
Table 50-a

Interrupt No.	Signal Name
02	KEY CONTROL
04	GP-IB
08	SWEEP END
0A	TIMER
0C	SWEEP STOP
0E	COUNTER
10	QP
12	OPTION (Unused)


04
Check I/O & GPIB board (BGP-010190).
IC21 and IC22 are defective.


08
Check RAMP GENERATOR board (BGP-010185).
Pin 10 of IC10 is at low level?
YES
IC6 is defective.
NO
Pin 2 of IC10 is at low level?
NO
IC10 is defective.
YES
IC15 and IC20 are defective.


0C
Check RAMP GENERATOR board (BGP-010185).
Press reset switch S215 on CPU board.
Negative pulse presents at pin 7 of IC20?
YES
IC17 is defective.
NO
IC20 is defective.


0E
Check ATTENUATOR I/O board (BGN-010220).
IC17 and IC23 are defective.

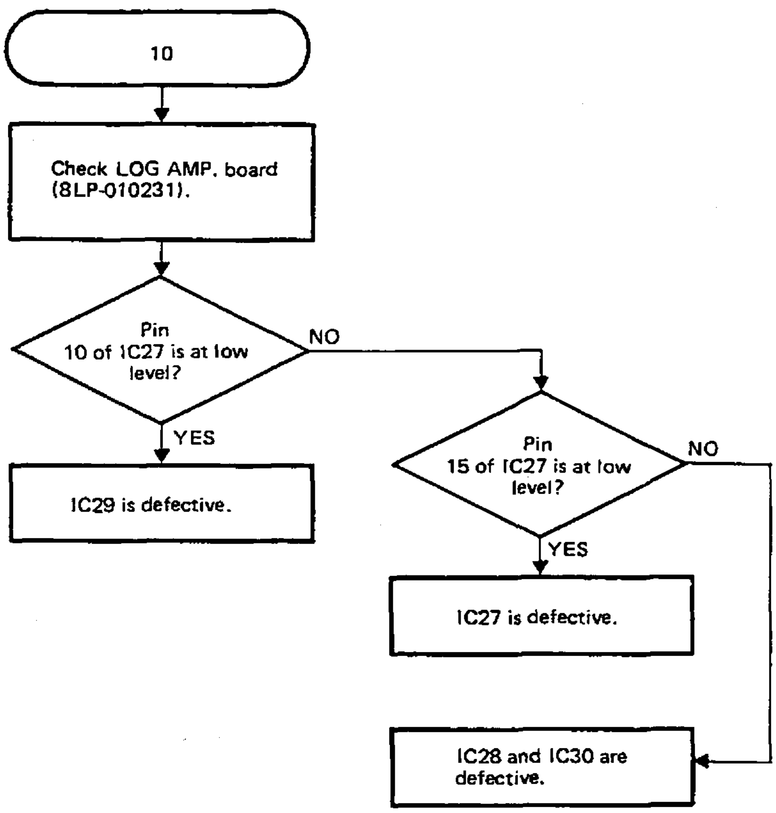

10
Check LOG AMP. board (8LP-010231).
Pin 10 of IC27 is at low level?
YES
IC29 is defective.
NO
Pin 15 of IC27 is at low level?
YES
IC27 is defective.
NO
IC28 and IC30 are defective.

CHART 50 Interrupt (Cont'd)

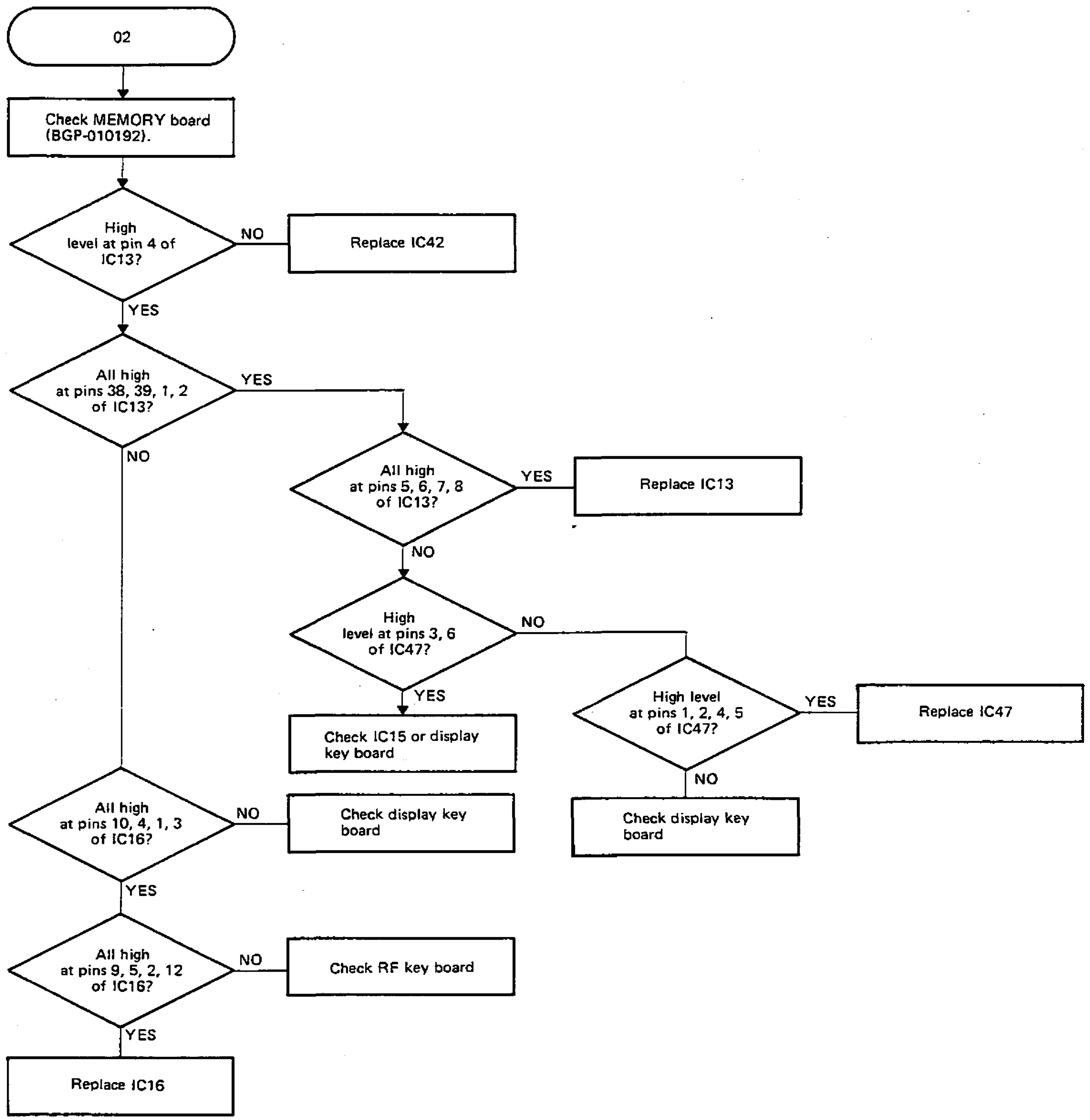
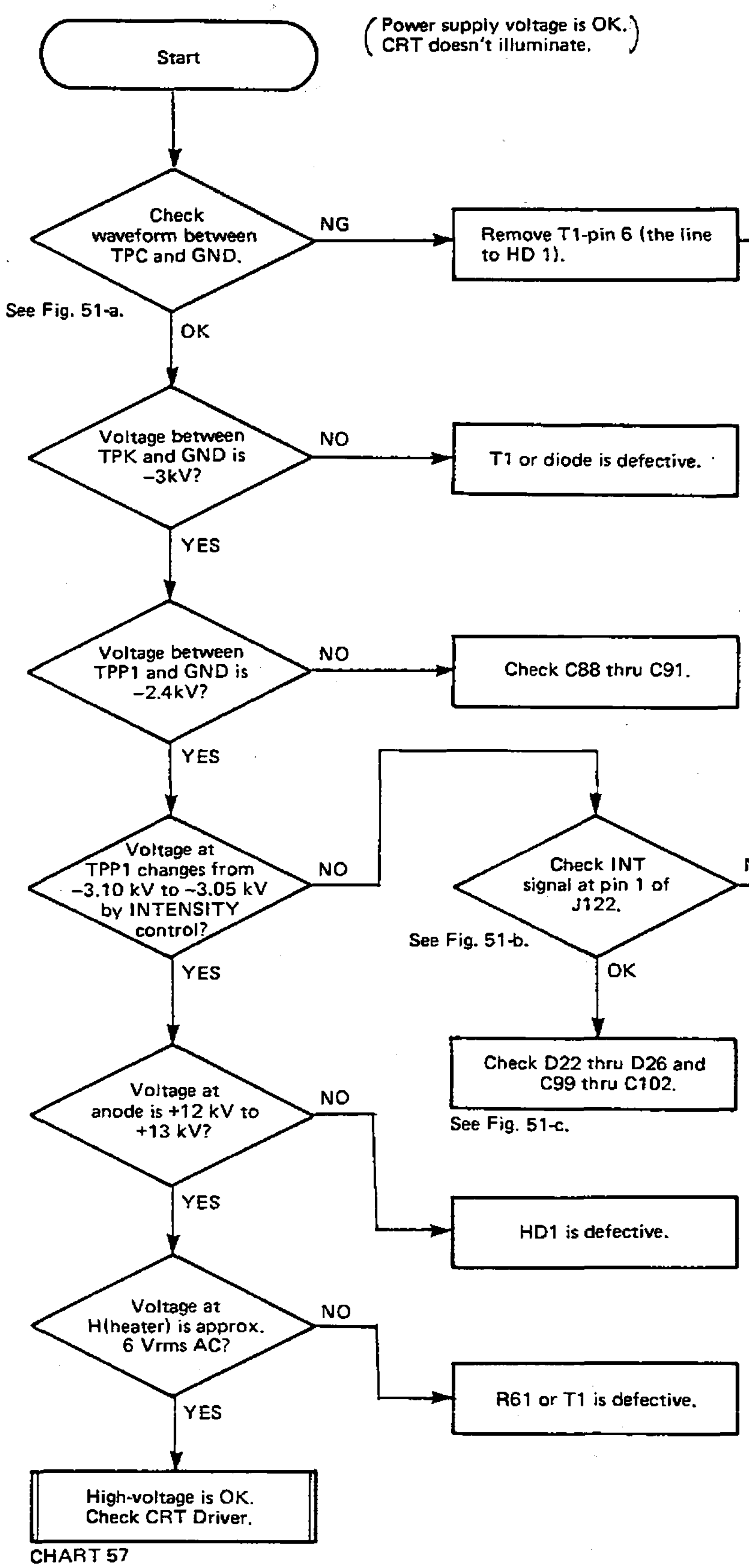
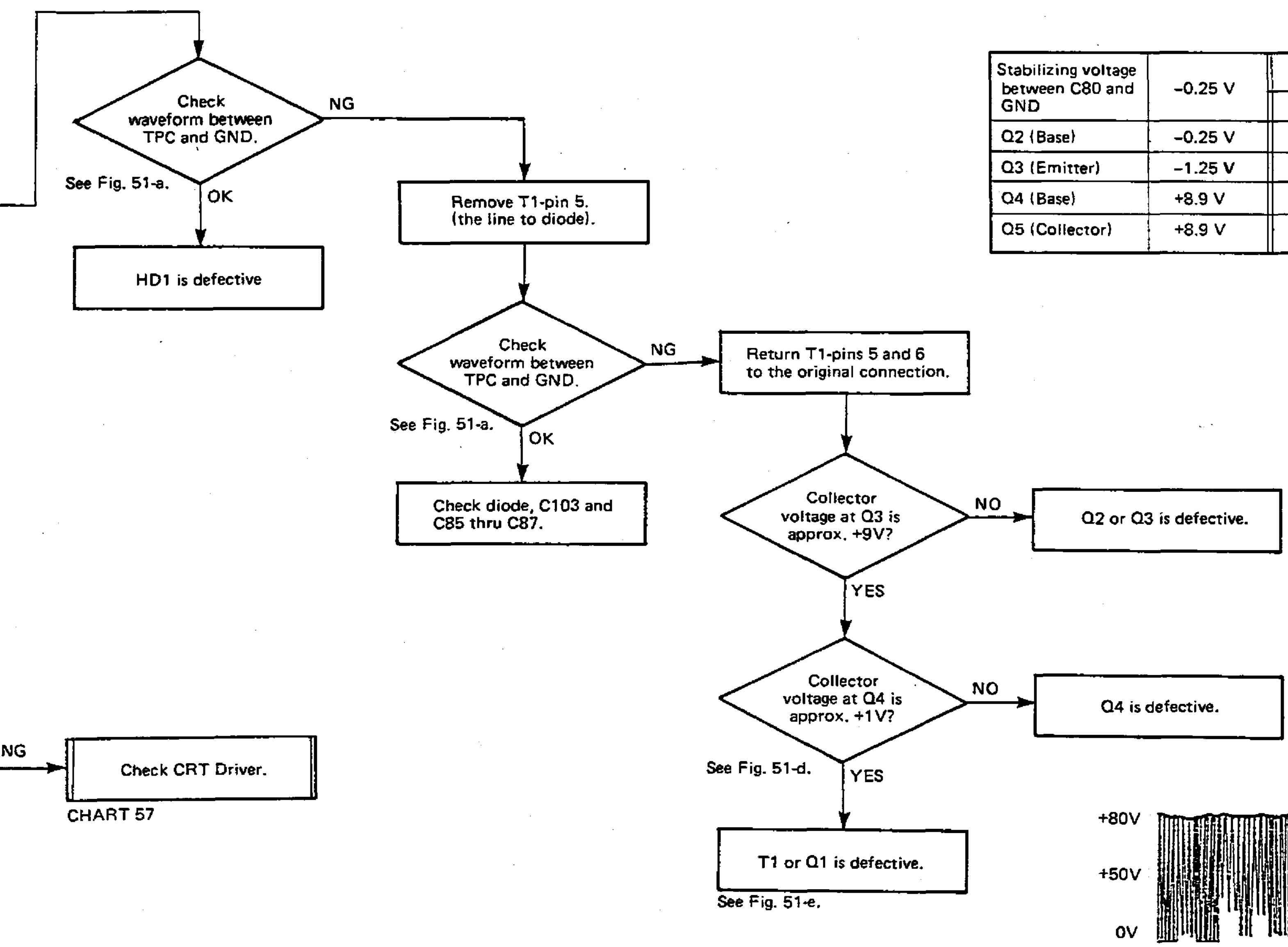


CHART 51 High Voltage

Stabilizing voltage between C80 and GND	-0.25 V	CRT, Anode	+12 kV ~ +13 kV
		P1	-2.4 kV
Q2 (Base)	-0.25 V	K	-3.00 kV
Q3 (Emitter)	-1.25 V	G1	-3.10 kV ↔ -3.05 kV (Minimum brightness) (Minimum brightness) Adjust INTENSITY control.
Q4 (Base)	+8.9 V		
Q5 (Collector)	+8.9 V		

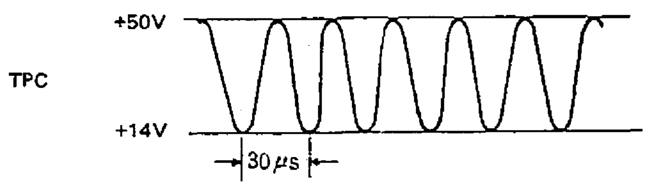


Fig. 51-a

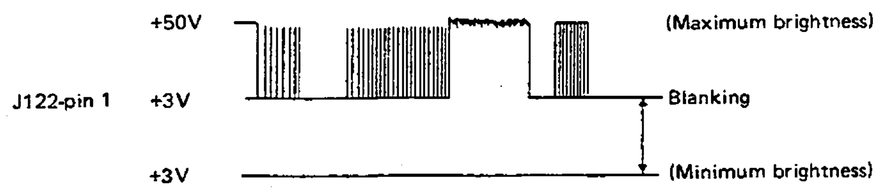


Fig. 51-b

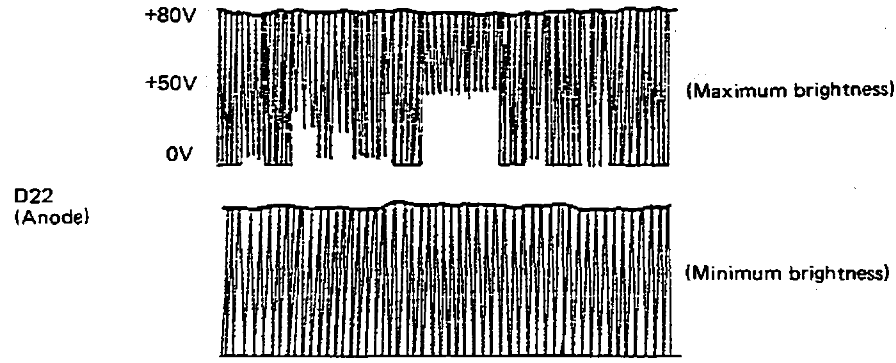


Fig. 51-c

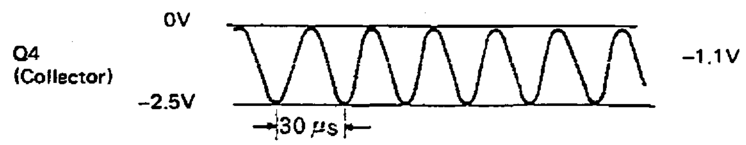


Fig. 51-d

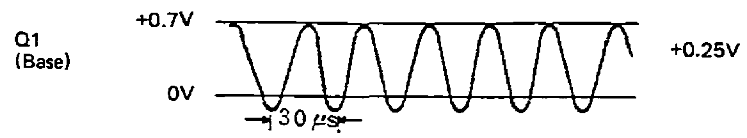


Fig. 51-e

CHART 52 Display Control

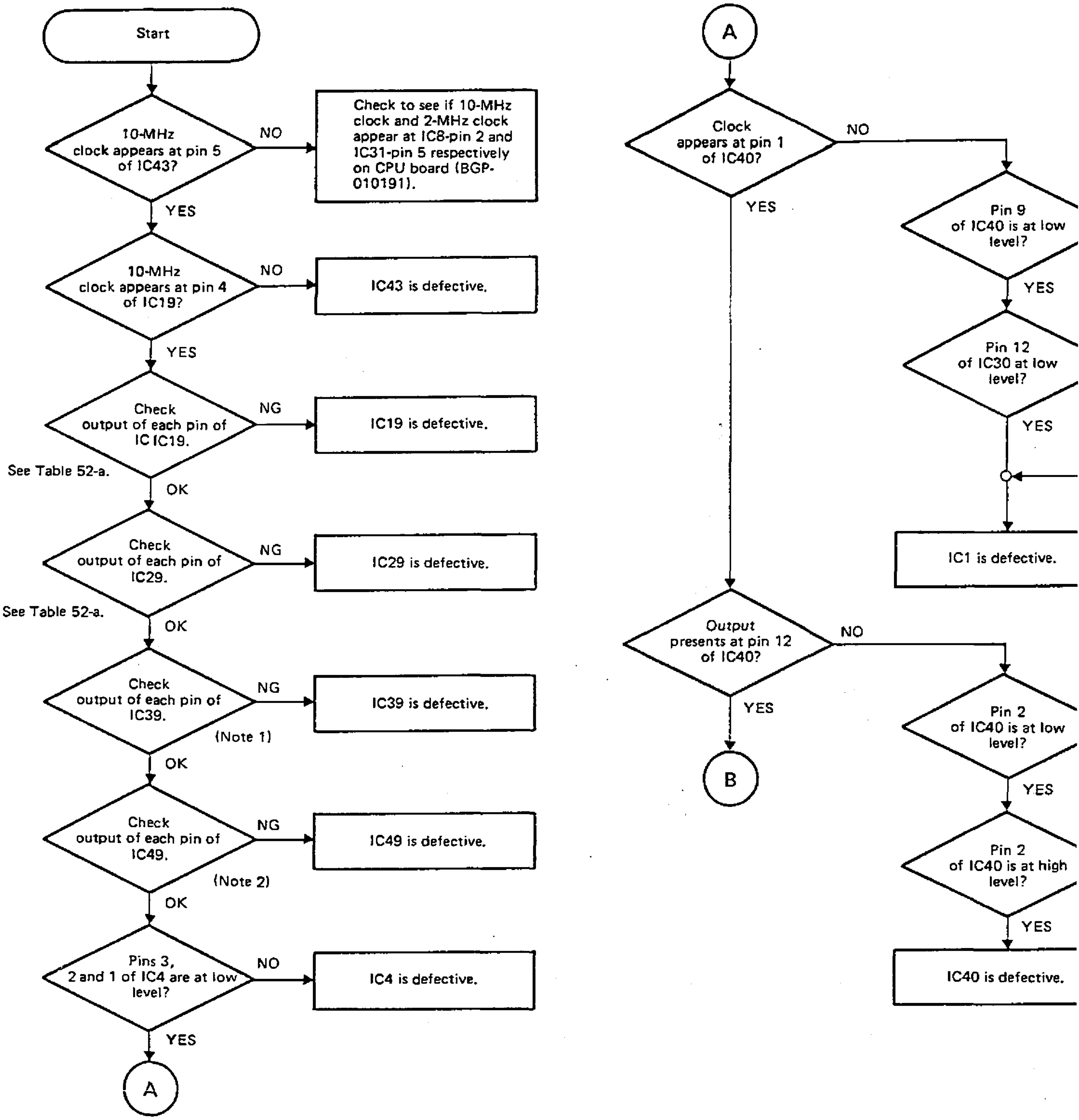
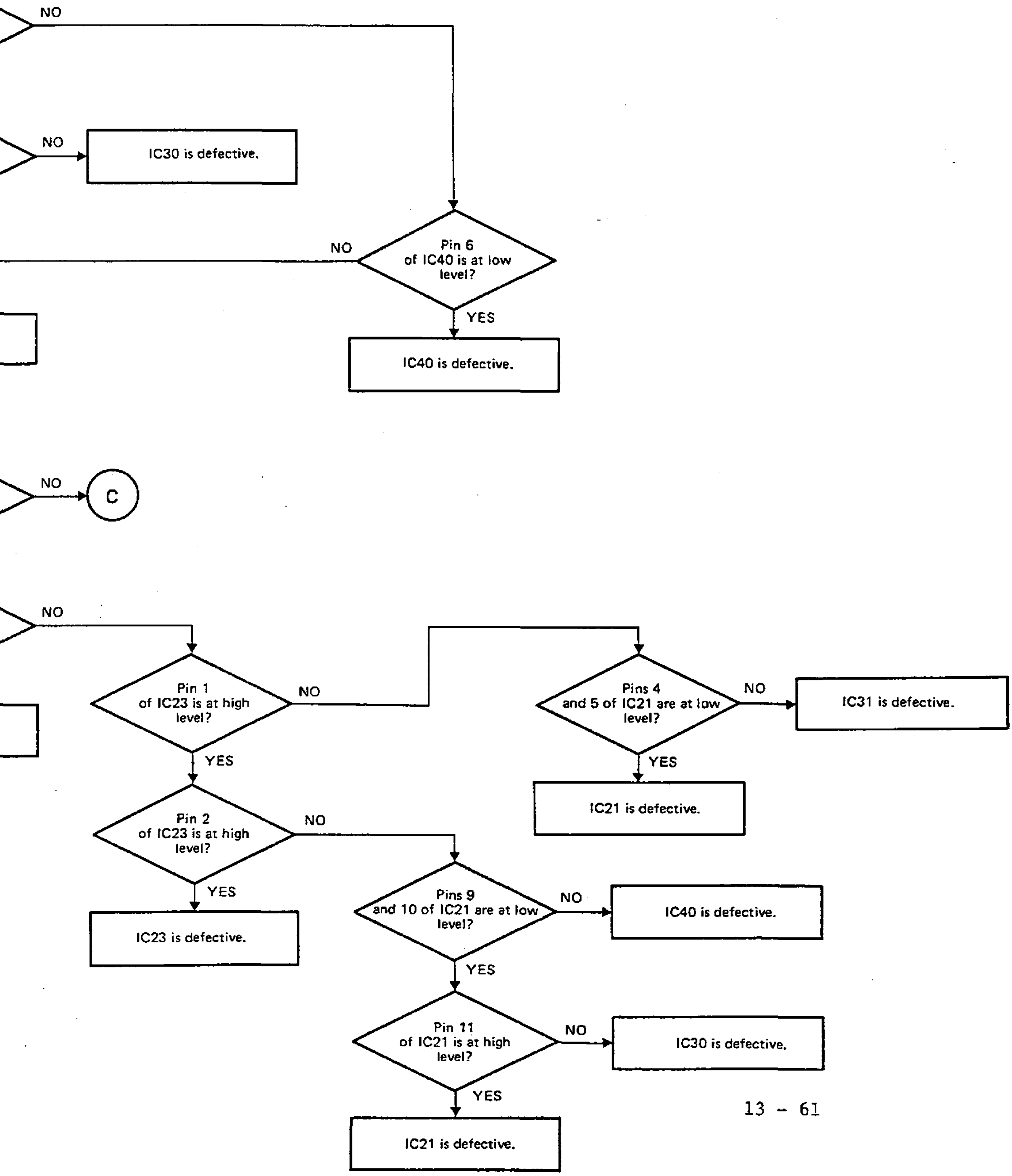


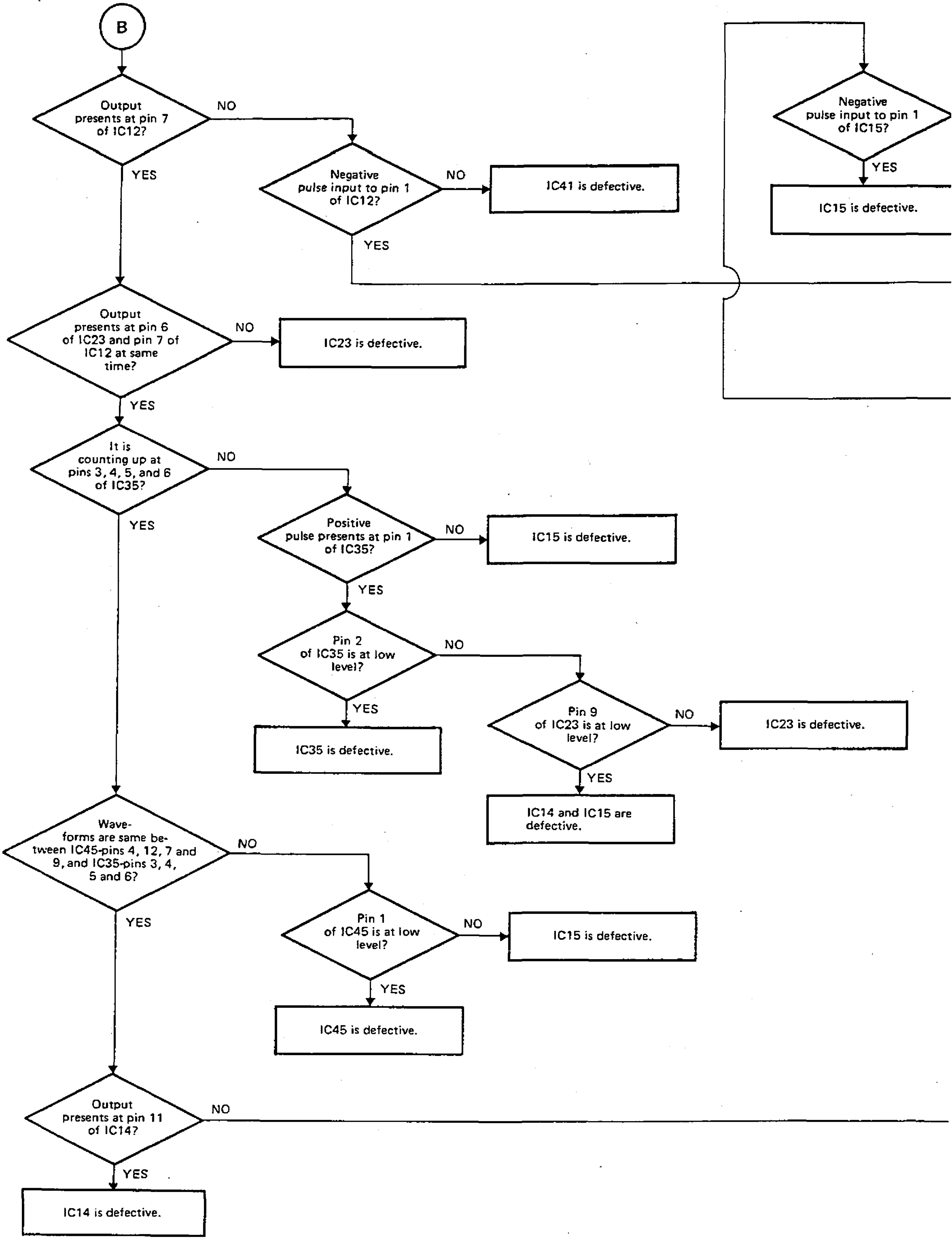
Table 52-a

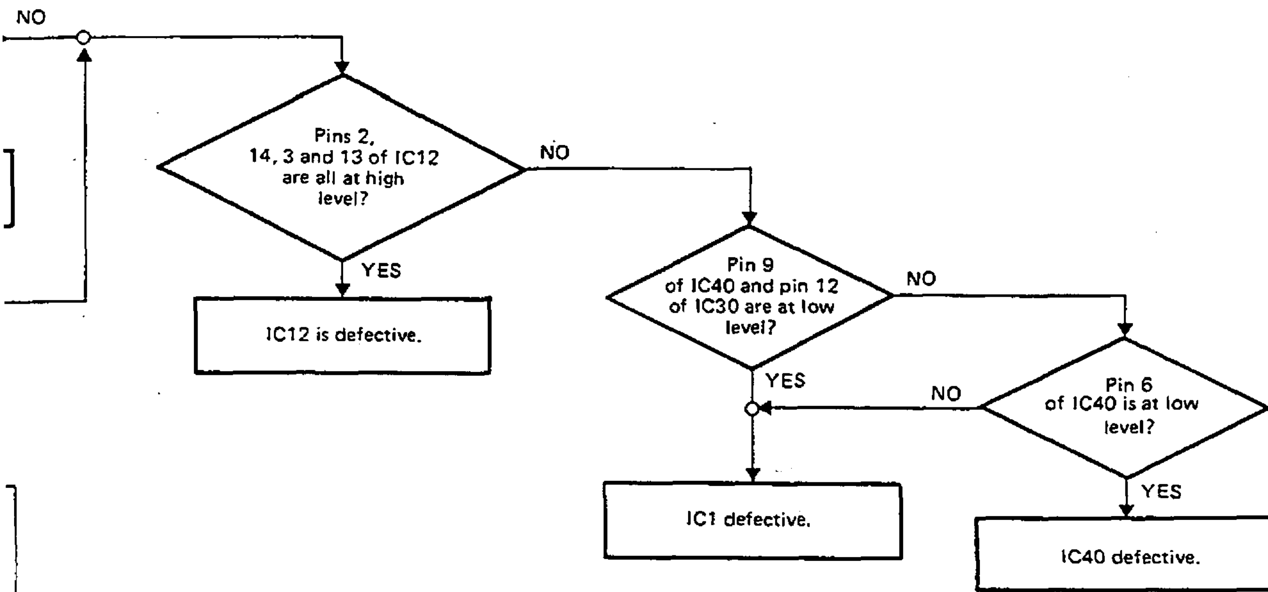
IC, pin No.	Signal name	Pulse width
IC19-Pin 5	CKA	250 μs
Pin 6	B	500 μs
Pin 7	C	500 μs
Pin 3	D	1 μs
IC29-Pins 12 and 13	CKE	2 μs
Pins 8 and 9	F	4 μs

Note 1: CK4 thru CK11 are clocks each of which has a pulse width of 4 μs and is issued after a delay of 500 μs.

Note 2: CK0 thru CK3 are clocks each of which has a pulse width of 2 μs and is issued after a delay of 500 μs.


NO
NO
IC30 is defective.
NO
Pin 6 of IC40 is at low level?
YES
IC40 is defective.
NO
C
NO
Pin 1 of IC23 is at high level?
NO
YES
Pins 4 and 5 of IC21 are at low level?
NO
IC31 is defective.
YES
IC21 is defective.
Pin 2 of IC23 is at high level?
NO
YES
IC23 is defective.
Pins 9 and 10 of IC21 are at low level?
NO
IC40 is defective.
YES
Pin 11 of IC21 is at high level?
NO
IC30 is defective.
YES
IC21 is defective.


B
Output presents at pin 7 of IC12?
NO
YES
Negative pulse input to pin 1 of IC12?
NO
IC41 is defective.
YES
Negative pulse input to pin 1 of IC15?
YES
IC15 is defective.
Output presents at pin 6 of IC23 and pin 7 of IC12 at same time?
NO
IC23 is defective.
YES
It is counting up at pins 3, 4, 5, and 6 of IC35?
NO
YES
Positive pulse presents at pin 1 of IC35?
NO
IC15 is defective.
YES
Pin 2 of IC35 is at low level?
NO
YES
IC35 is defective.
Pin 9 of IC23 is at low level?
NO
IC23 is defective.
YES
IC14 and IC15 are defective.
Wave-forms are same be-tween IC45-pins 4, 12, 7 and 9, and IC35-pins 3, 4, 5 and 6?
NO
YES
Pin 1 of IC45 is at low level?
NO
IC15 is defective.
YES
IC45 is defective.
Output presents at pin 11 of IC14?
NO
YES
IC14 is defective.



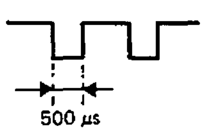


Fig. 52-a

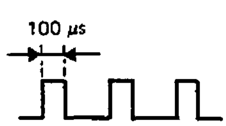


Fig. 52-b

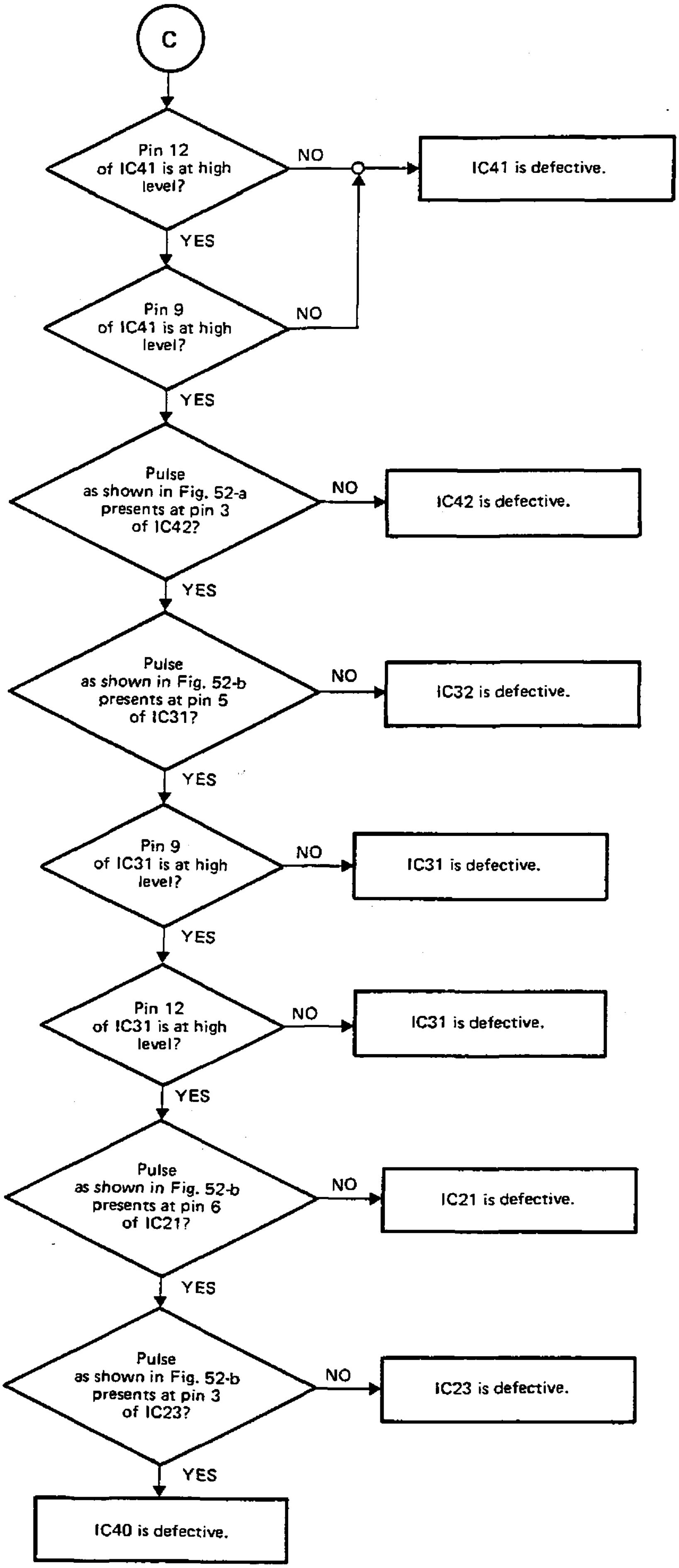

C
Pin 12 of IC41 is at high level?
NO
IC41 is defective.
YES
Pin 9 of IC41 is at high level?
NO
YES
Pulse as shown in Fig. 52-a presents at pin 3 of IC42?
NO
IC42 is defective.
YES
Pulse as shown in Fig. 52-b presents at pin 5 of IC31?
NO
IC32 is defective.
YES
Pin 9 of IC31 is at high level?
NO
IC31 is defective.
YES
Pin 12 of IC31 is at high level?
NO
IC31 is defective.
YES
Pulse as shown in Fig. 52-b presents at pin 6 of IC21?
NO
IC21 is defective.
YES
Pulse as shown in Fig. 52-b presents at pin 3 of IC23?
NO
IC23 is defective.
YES
IC40 is defective.

CHART 53 Analog I/O Mag. Amp.

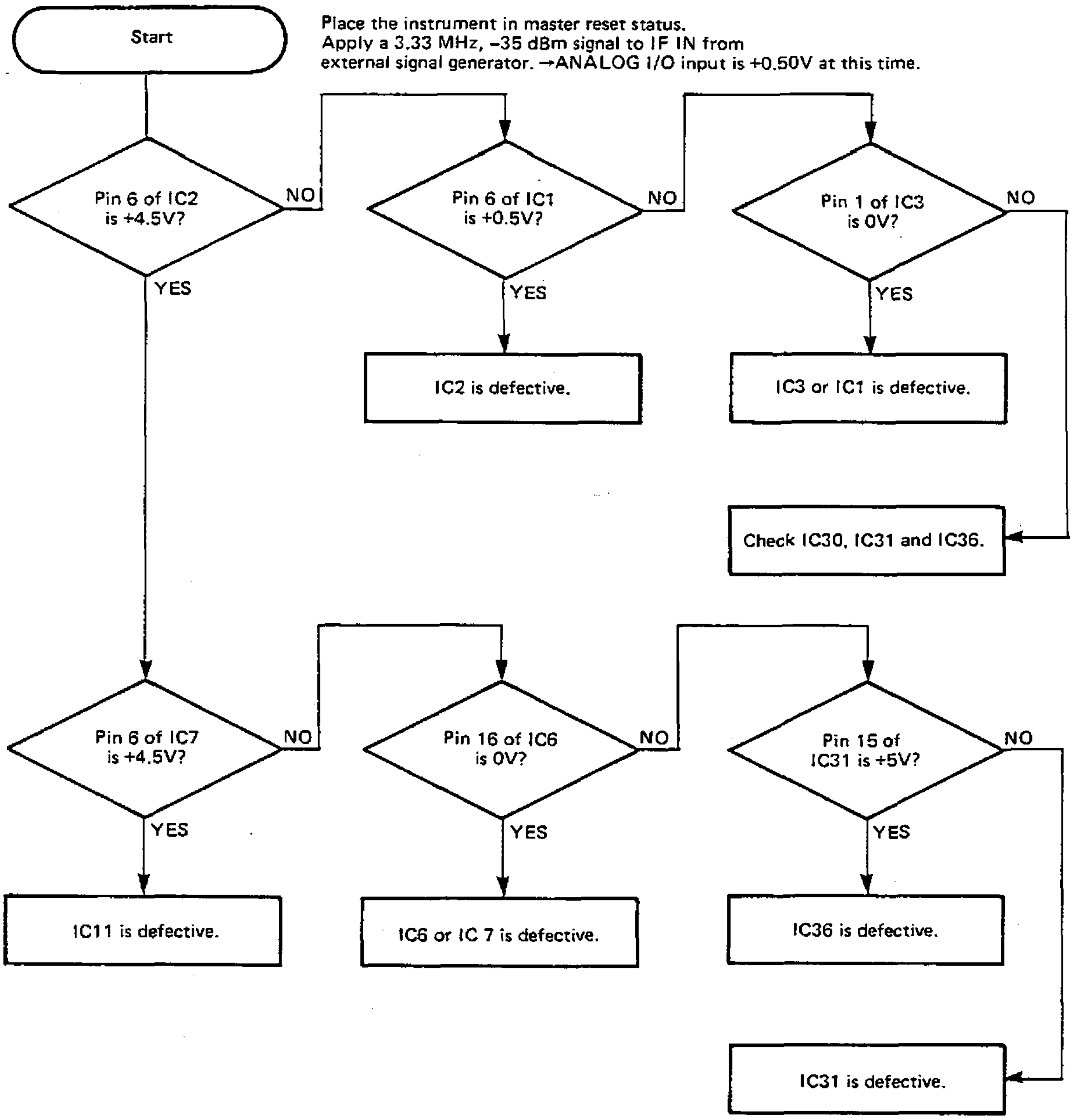
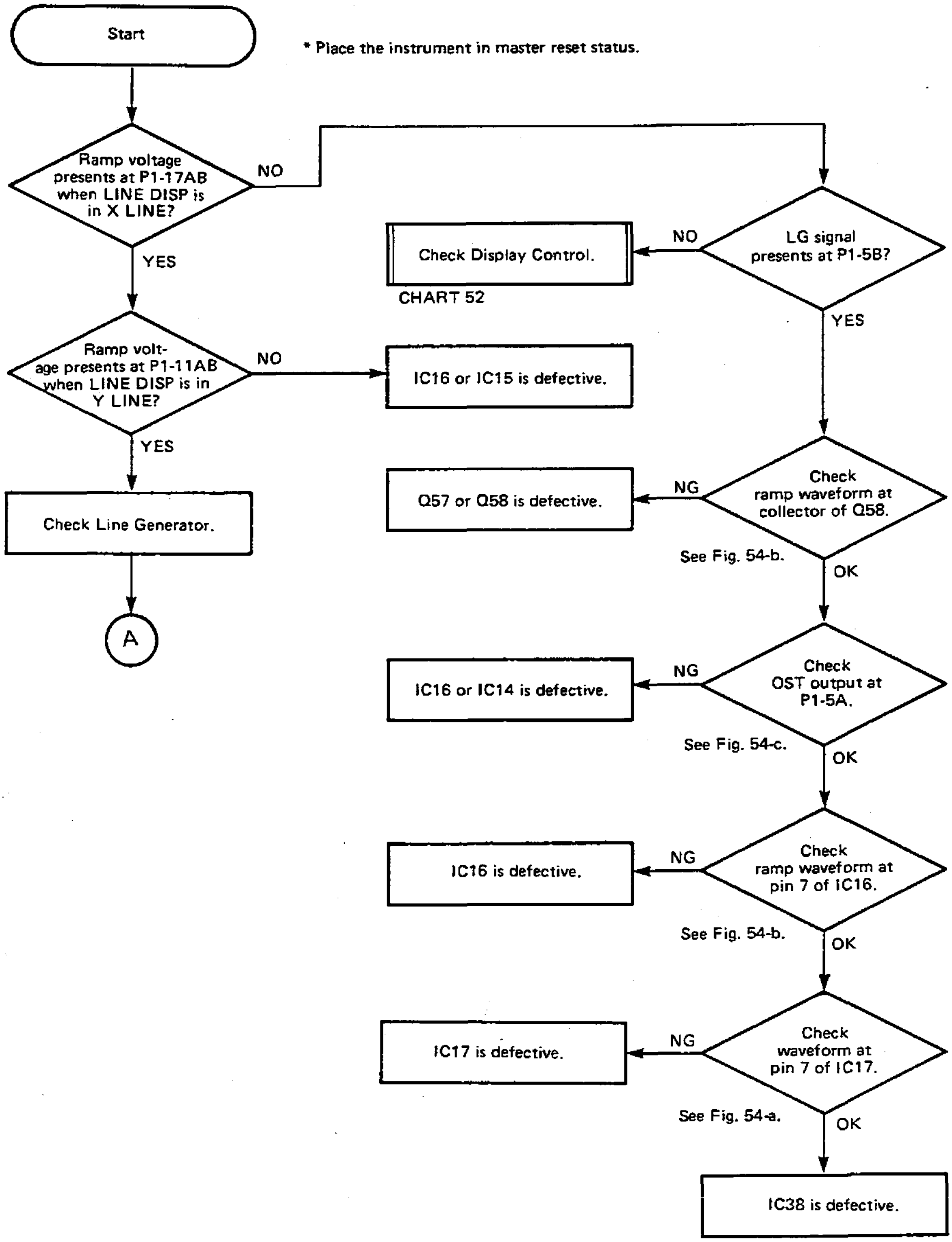
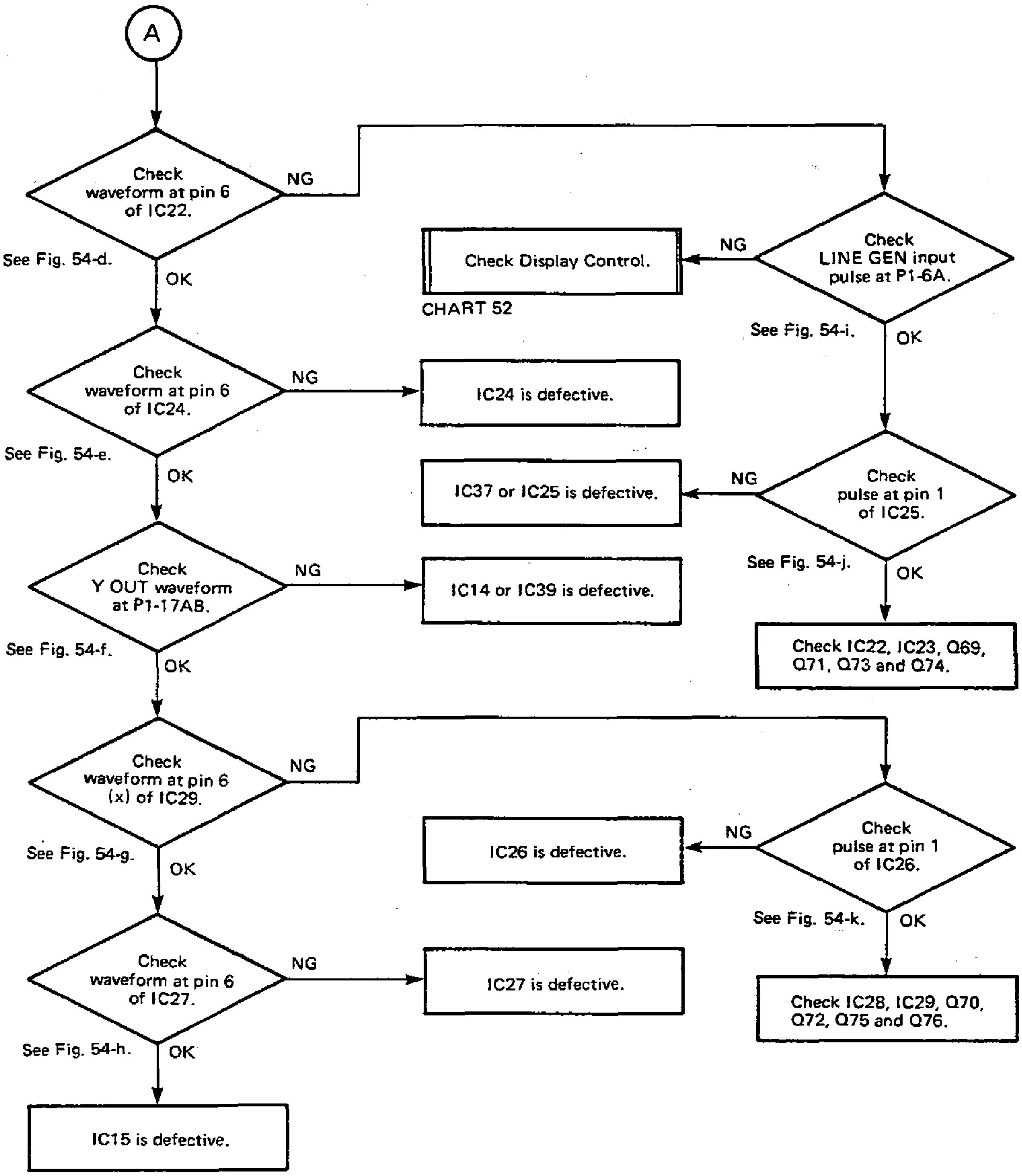


CHART 54 Analog I/O Ramp Gen./Line Gen.




A
Check waveform at pin 6 of IC22.
See Fig. 54-d.
NG
OK
Check LINE GEN input pulse at P1-6A.
See Fig. 54-i.
NG
Check Display Control.
CHART 52
OK
Check pulse at pin 1 of IC25.
See Fig. 54-j.
NG
IC37 or IC25 is defective.
OK
Check IC22, IC23, Q69, Q71, Q73 and Q74.
Check waveform at pin 6 of IC24.
See Fig. 54-e.
NG
IC24 is defective.
OK
Check Y OUT waveform at P1-17AB.
See Fig. 54-f.
NG
IC14 or IC39 is defective.
OK
Check waveform at pin 6 (x) of IC29.
See Fig. 54-g.
NG
Check pulse at pin 1 of IC26.
See Fig. 54-k.
NG
IC26 is defective.
OK
Check IC28, IC29, Q70, Q72, Q75 and Q76.
OK
Check waveform at pin 6 of IC27.
See Fig. 54-h.
NG
IC27 is defective.
OK
IC15 is defective.

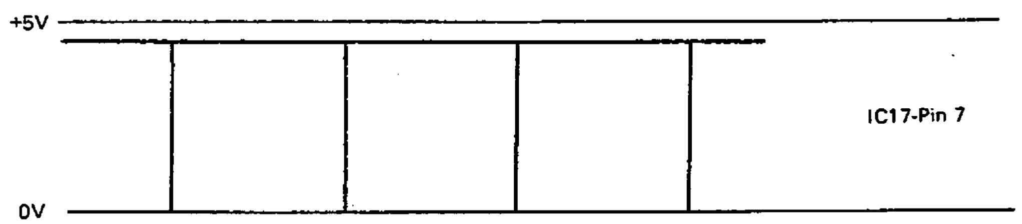


Fig. 54-a

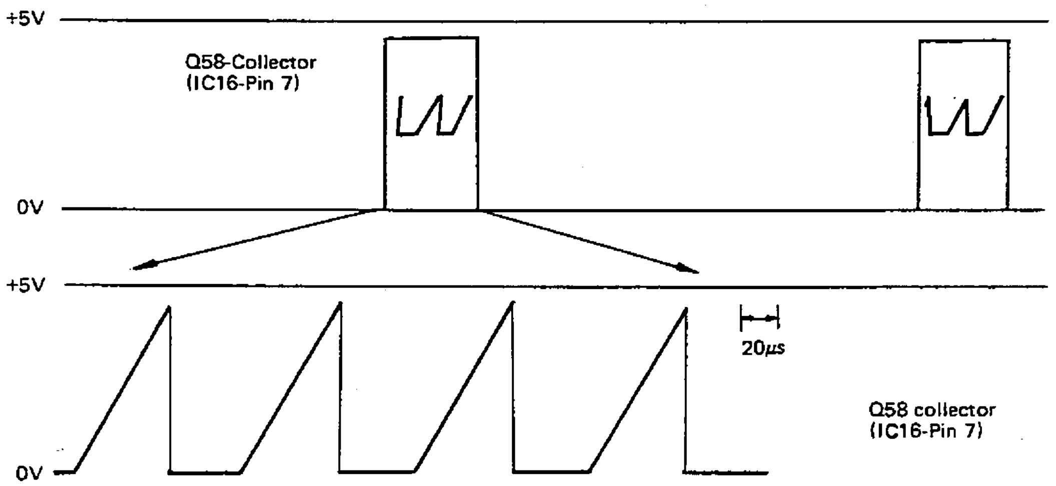


Fig. 54-b

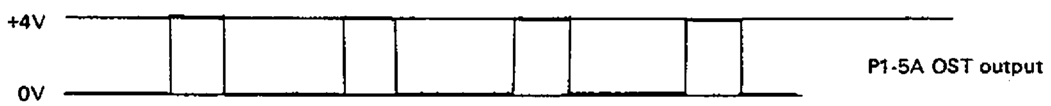


Fig. 54-c

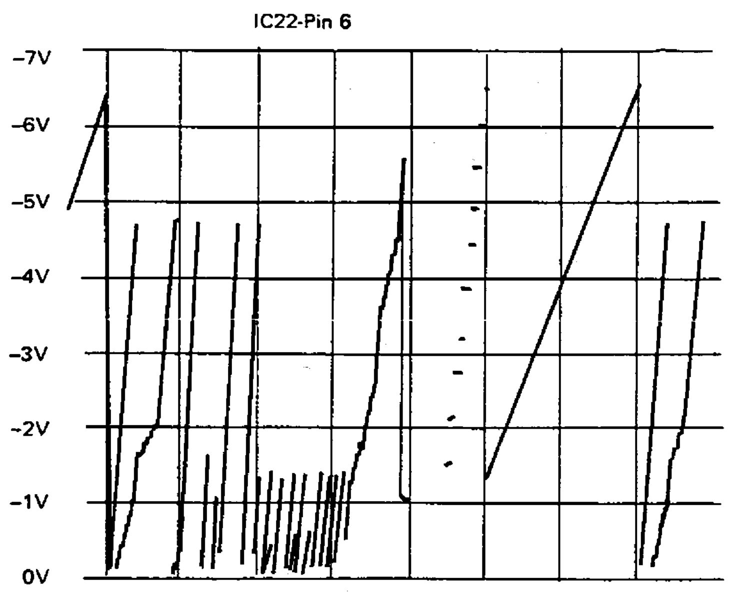


Fig. 54-d

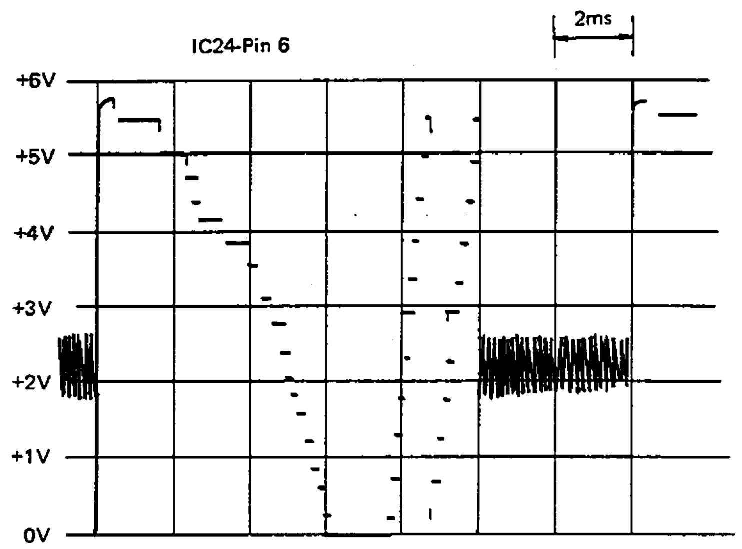


Fig. 54-e

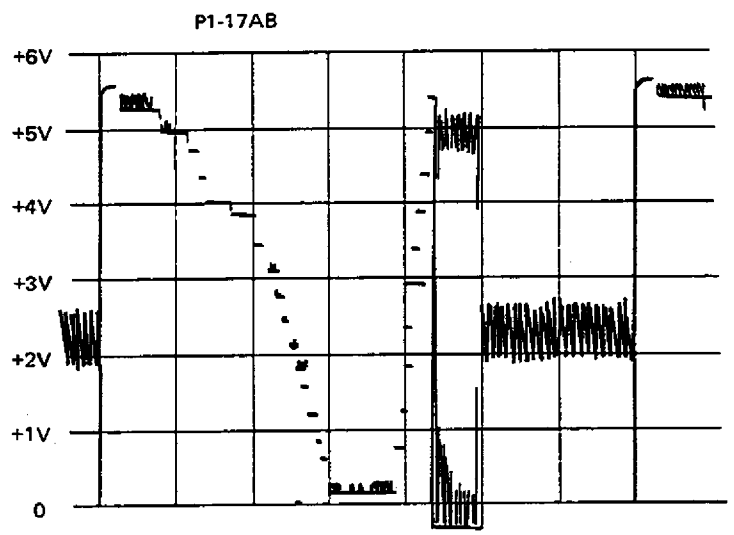


Fig. 54-f

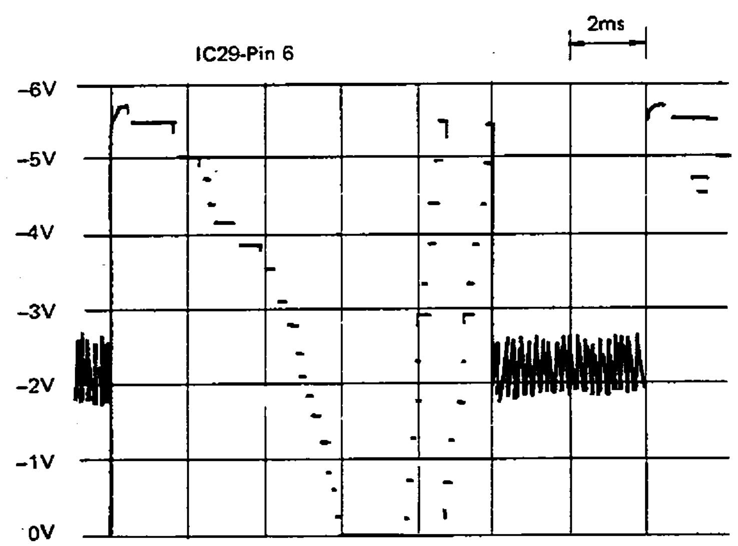


Fig. 54-g

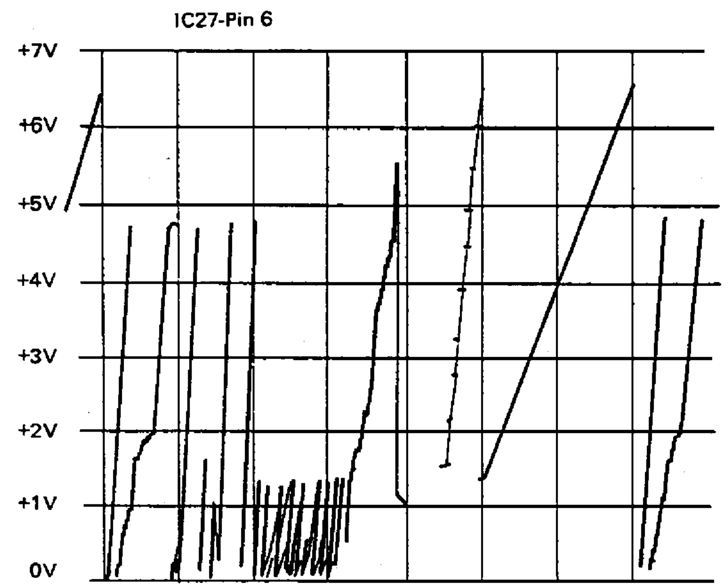


Fig. 54-h

Fig. 54-i

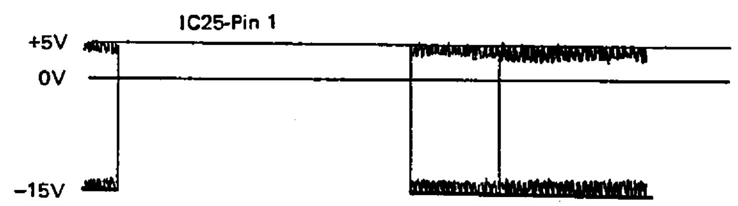


Fig. 54-j

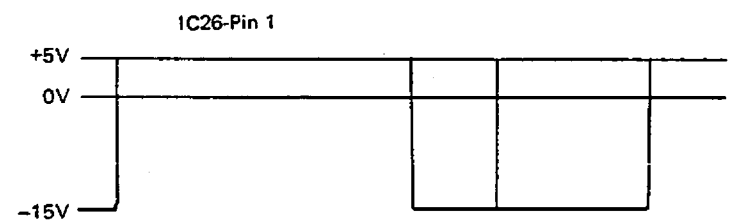
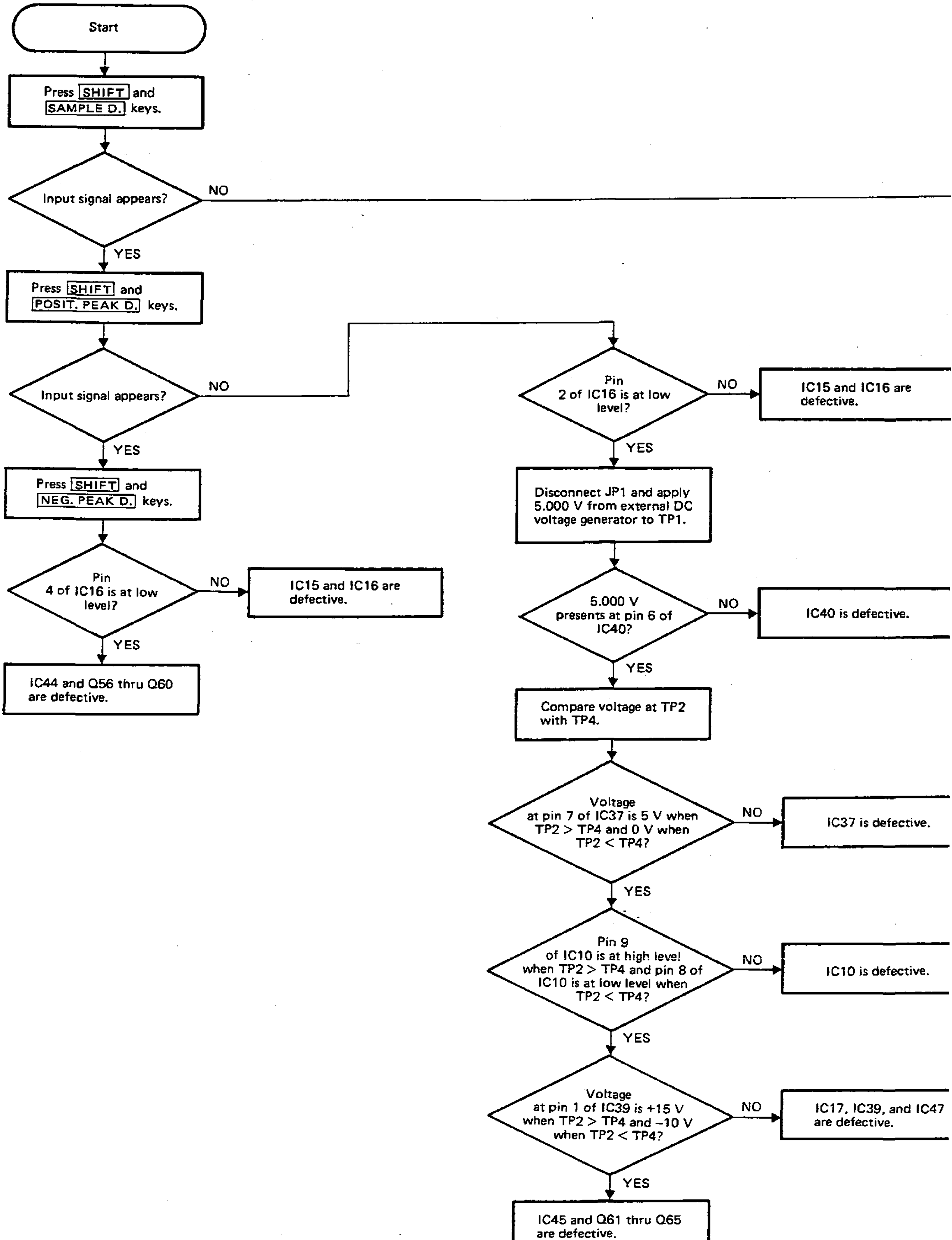
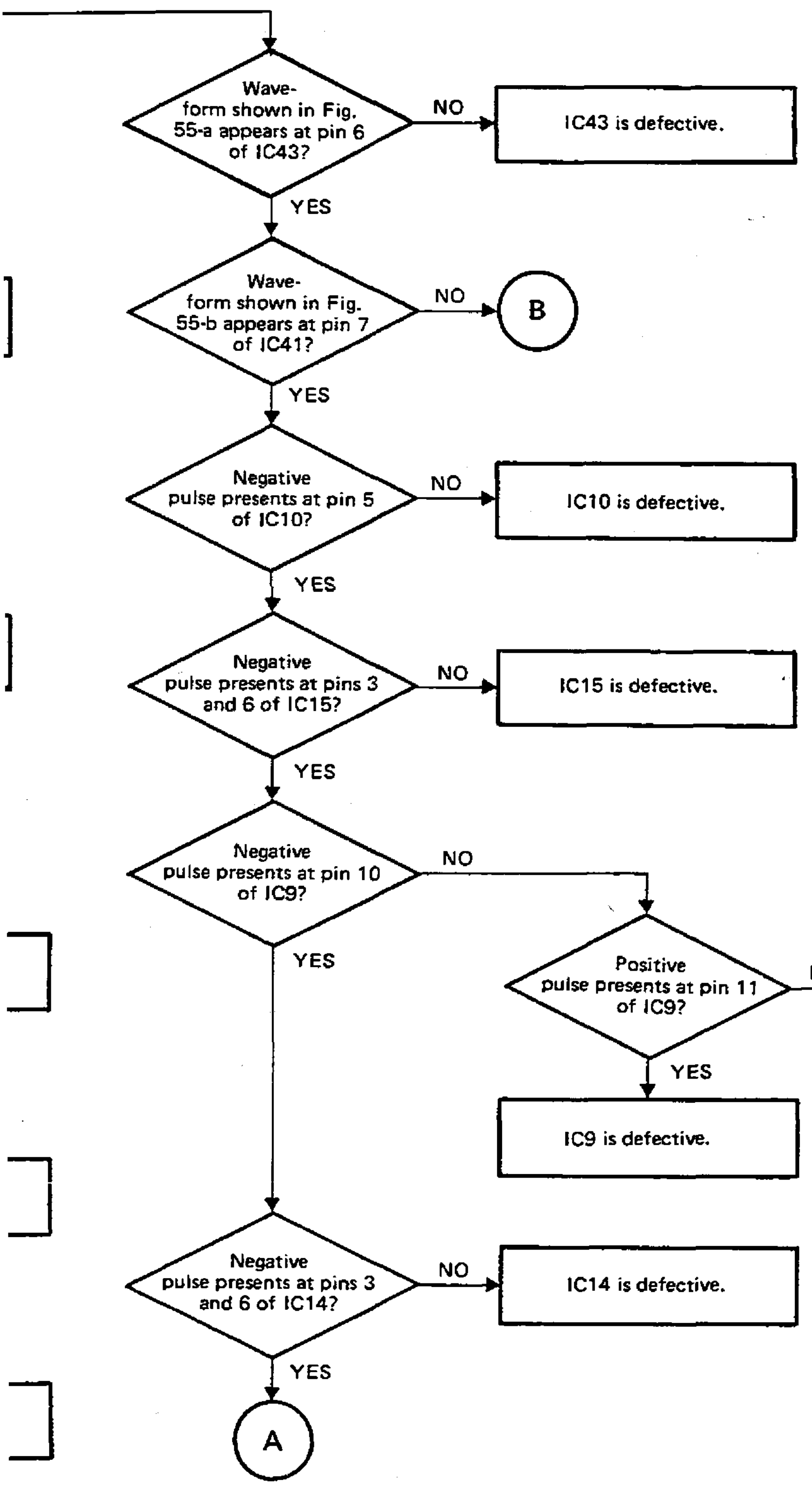


Fig. 54-k

CHART 55 A-D Converter





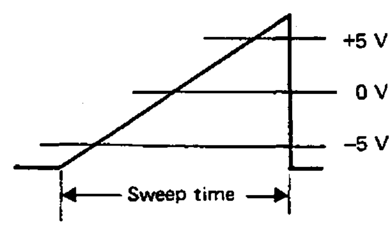


Fig. 55-a

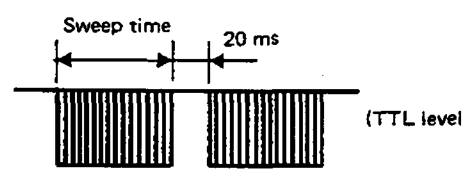
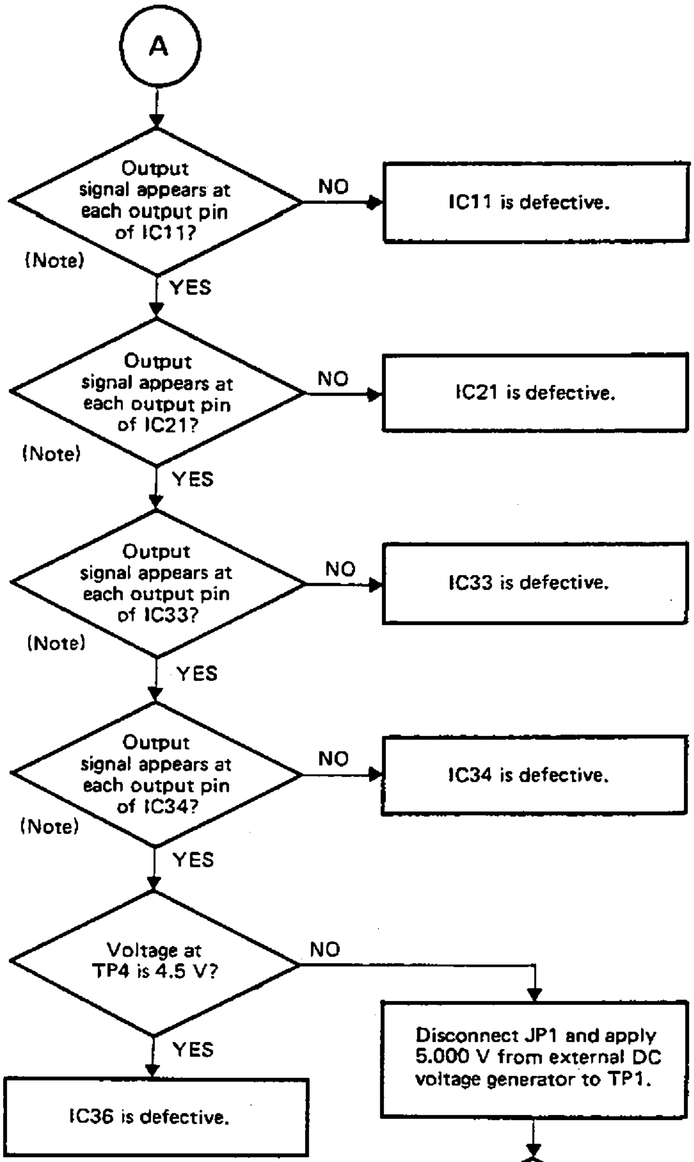
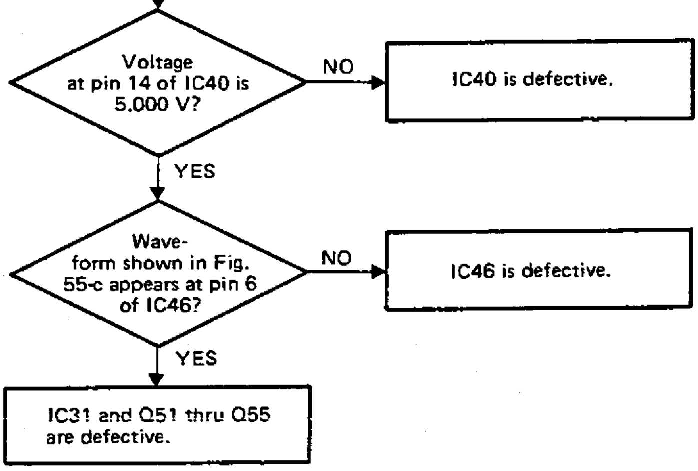


Fig. 55-b





Note: Outputs of IC11, IC21, IC33 and IC34 present when CHIP SELECT terminal (pin 1 or pins 1 and 19) is at low level.

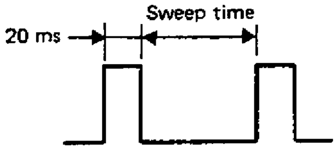


Fig. 55-d

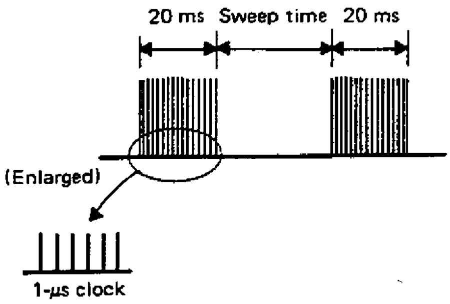


Fig. 55-f

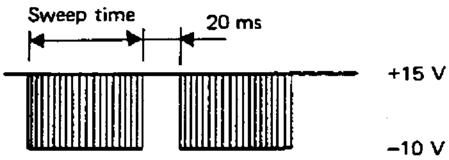


Fig. 55-c

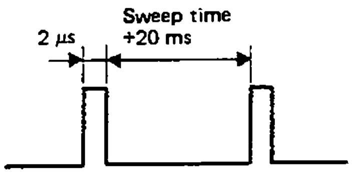
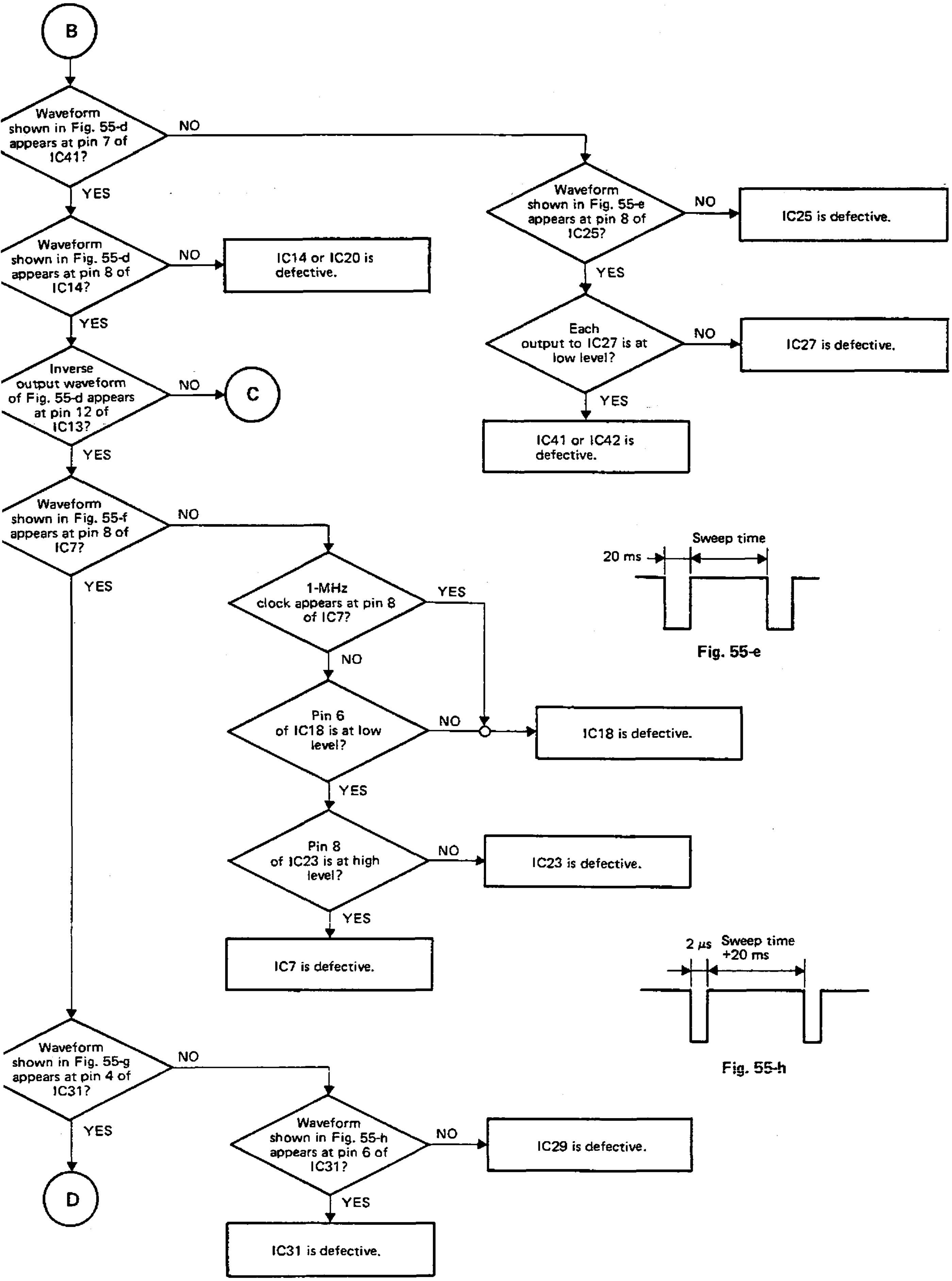
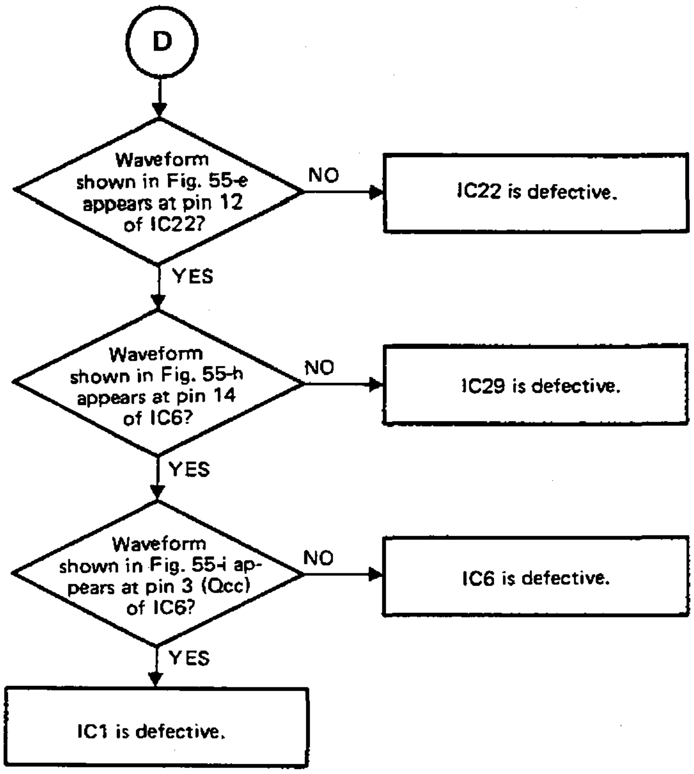
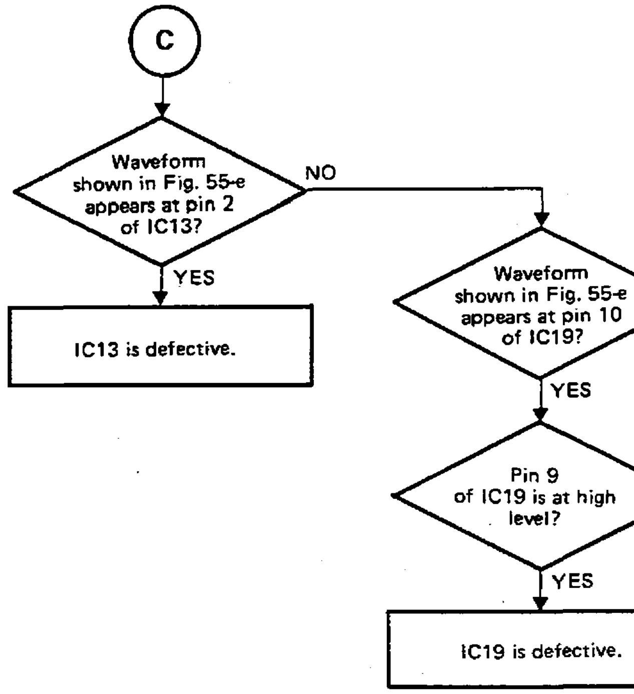


Fig. 55-g



B
Waveform shown in Fig. 55-d appears at pin 7 of IC41?
NO
YES
Waveform shown in Fig. 55-d appears at pin 8 of IC14?
NO
IC14 or IC20 is defective.
YES
Inverse output waveform of Fig. 55-d appears at pin 12 of IC13?
NO
C
YES
Waveform shown in Fig. 55-f appears at pin 8 of IC7?
NO
YES
1-MHz clock appears at pin 8 of IC7?
YES
NO
Pin 6 of IC18 is at low level?
NO
IC18 is defective.
YES
Pin 8 of IC23 is at high level?
NO
IC23 is defective.
YES
IC7 is defective.
Waveform shown in Fig. 55-g appears at pin 4 of IC31?
NO
YES
D
Waveform shown in Fig. 55-h appears at pin 6 of IC31?
NO
IC29 is defective.
YES
IC31 is defective.
Waveform shown in Fig. 55-e appears at pin 8 of IC25?
NO
IC25 is defective.
YES
Each output to IC27 is at low level?
NO
IC27 is defective.
YES
IC41 or IC42 is defective.
Sweep time
20 ms
Fig. 55-e
2 μs
Sweep time +20 ms
Fig. 55-h


D
Waveform shown in Fig. 55-e appears at pin 12 of IC22?
NO
IC22 is defective.
YES
Waveform shown in Fig. 55-h appears at pin 14 of IC6?
NO
IC29 is defective.
YES
Waveform shown in Fig. 55-i appears at pin 3 (Qcc) of IC6?
NO
IC6 is defective.
YES
IC1 is defective.


C
Waveform shown in Fig. 55-e appears at pin 2 of IC13?
NO
YES
IC13 is defective.
Waveform shown in Fig. 55-e appears at pin 10 of IC19?
YES
Pin 9 of IC19 is at high level?
YES
IC19 is defective.

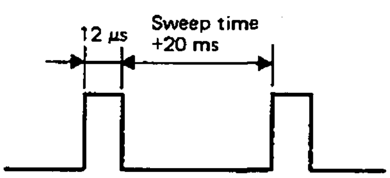

12 µs
Sweep time
+20 ms

Fig. 55-i

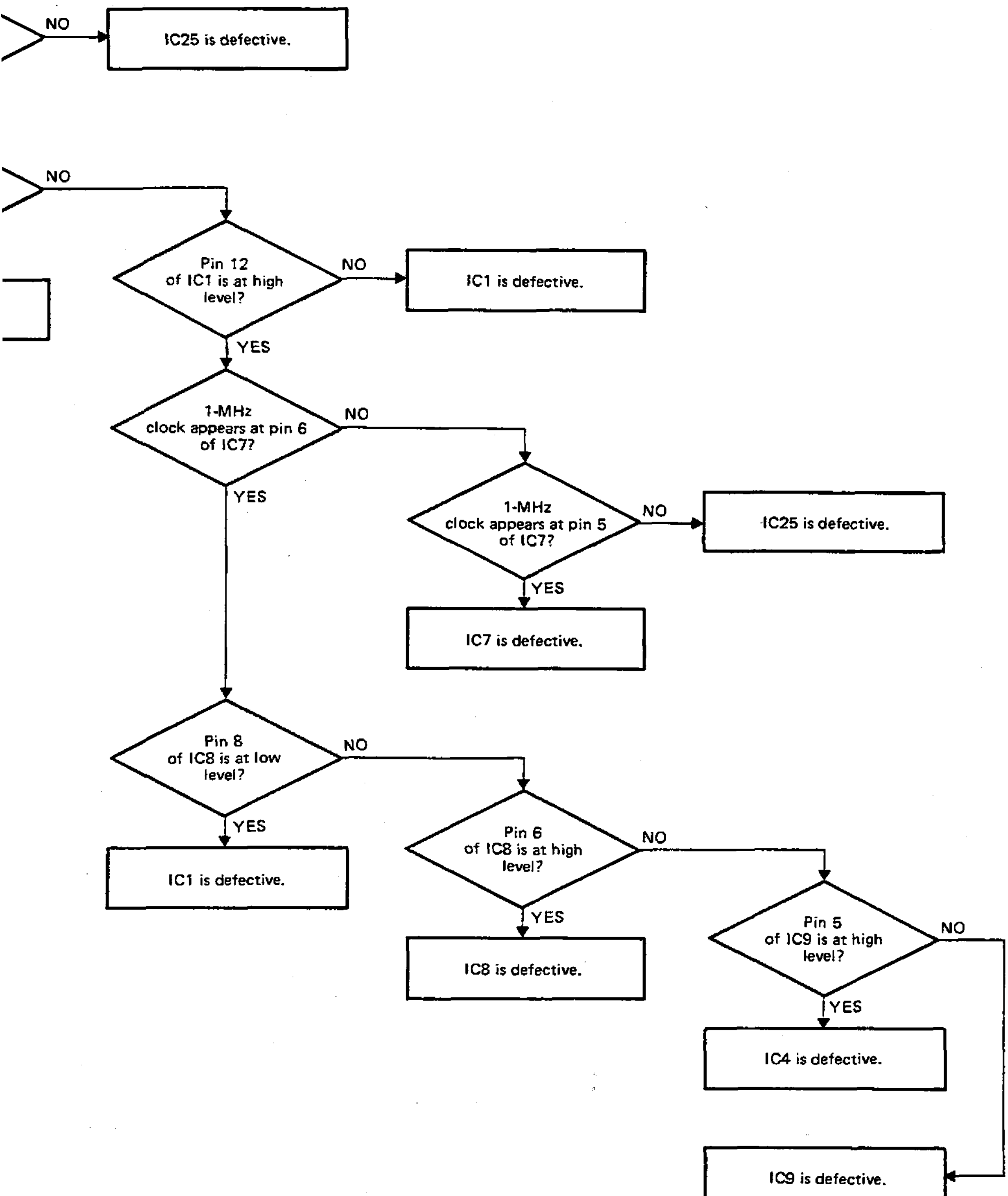
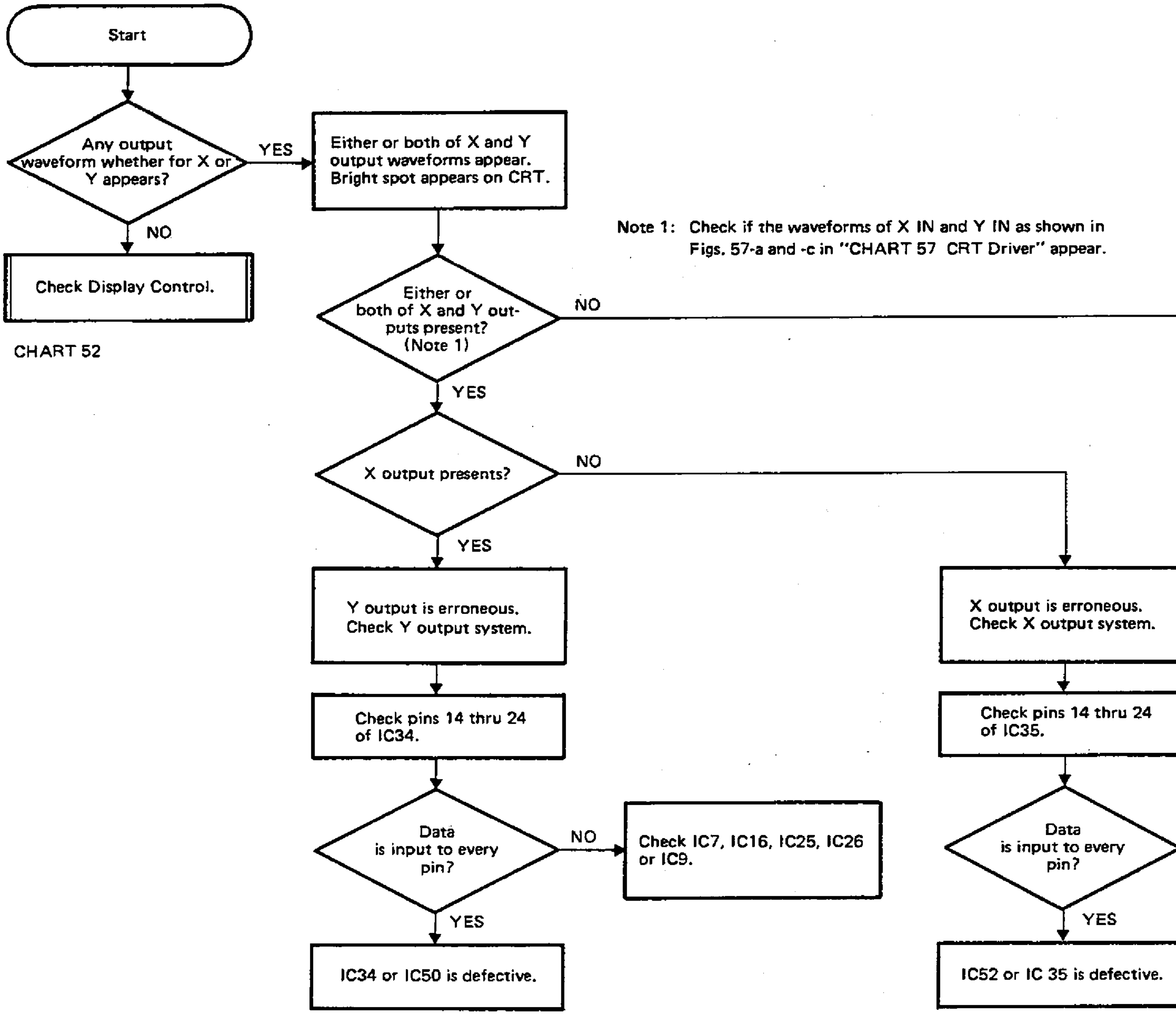
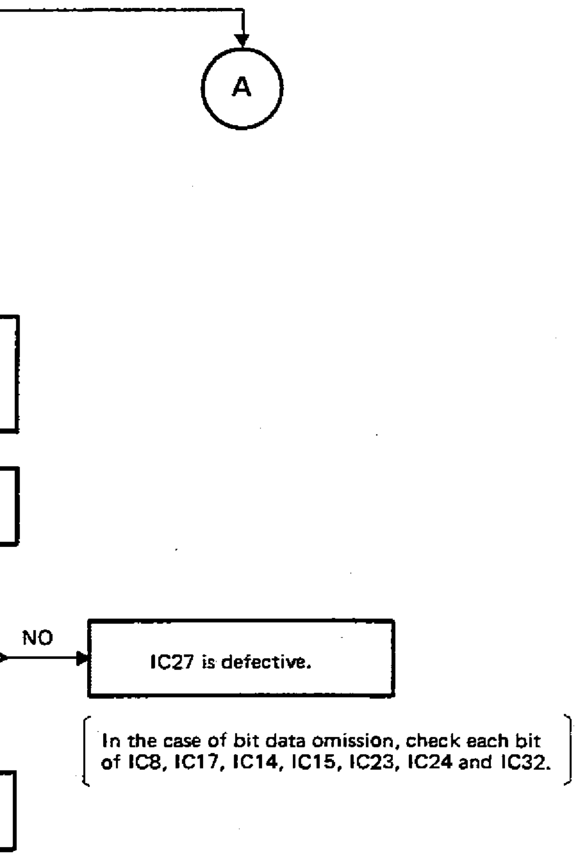
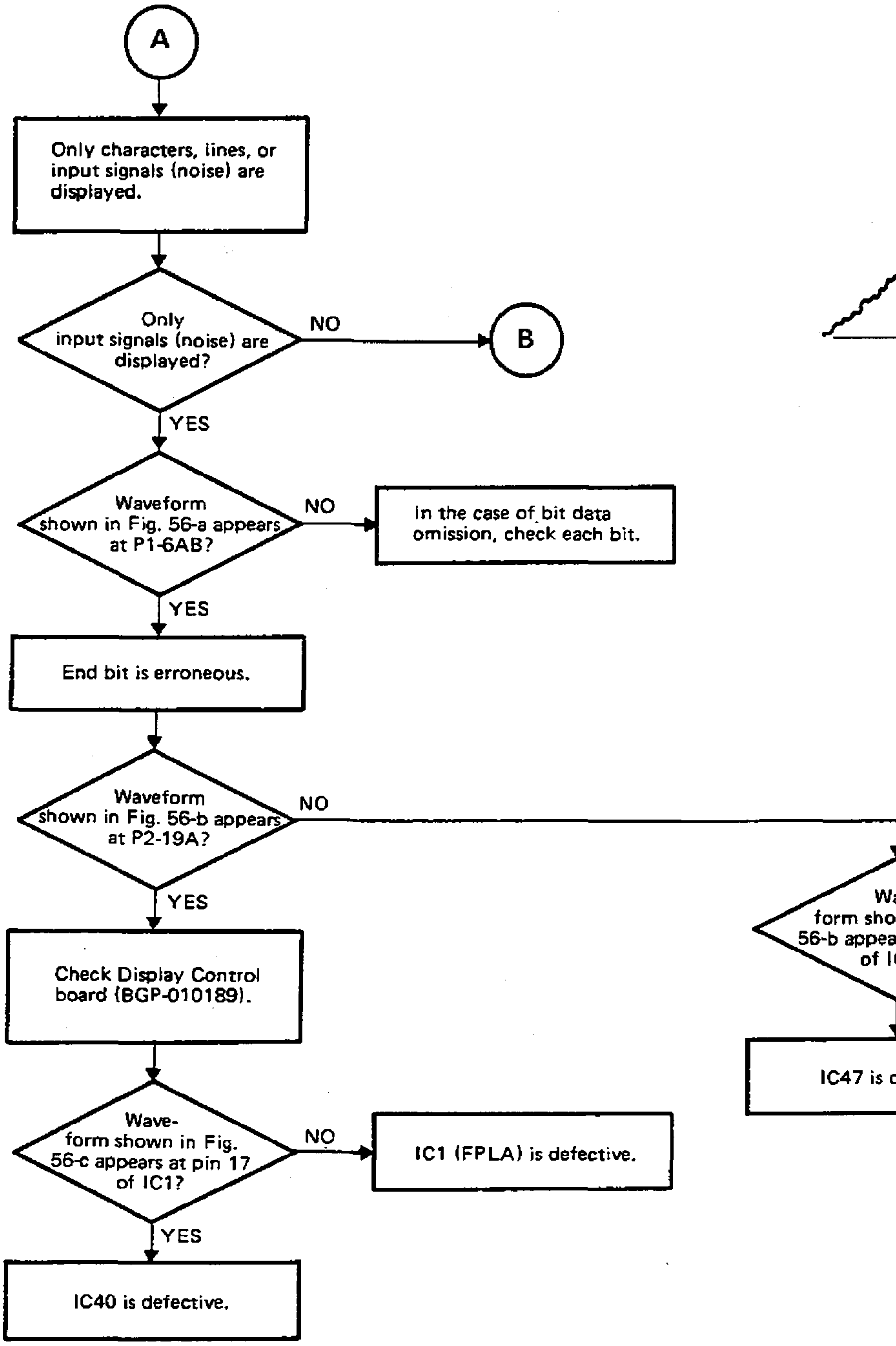
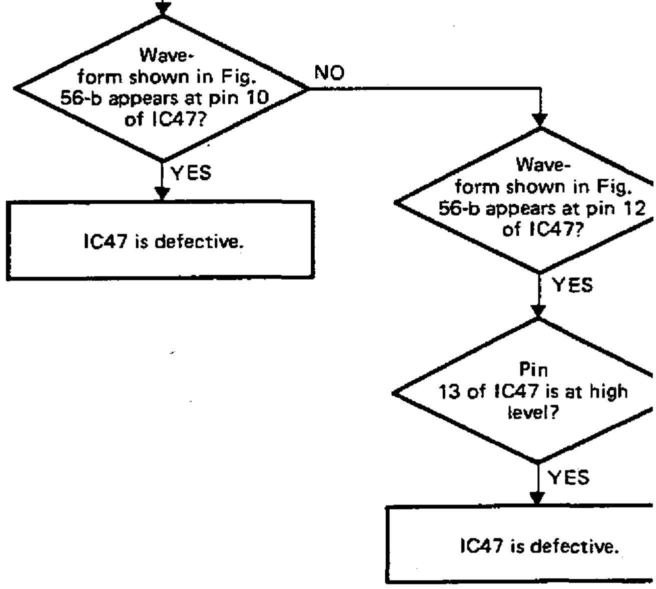

NO
IC25 is defective.
NO
Pin 12 of IC1 is at high level?
NO
IC1 is defective.
YES
1-MHz clock appears at pin 6 of IC7?
NO
YES
1-MHz clock appears at pin 5 of IC7?
NO
IC25 is defective.
YES
IC7 is defective.
Pin 8 of IC8 is at low level?
NO
YES
IC1 is defective.
Pin 6 of IC8 is at high level?
NO
YES
IC8 is defective.
Pin 5 of IC9 is at high level?
NO
YES
IC4 is defective.
IC9 is defective.

CHART 56 D-A Converter




A
NO
IC27 is defective.
In the case of bit data omission, check each bit of IC8, IC17, IC14, IC15, IC23, IC24 and IC32.





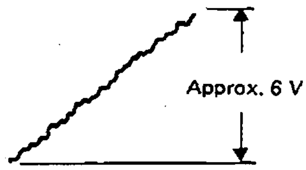


Fig. 56-a

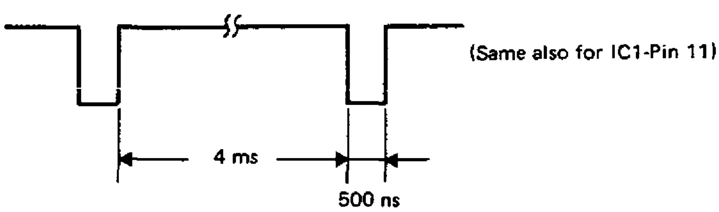


Fig. 56-c

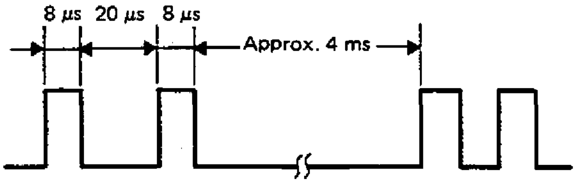
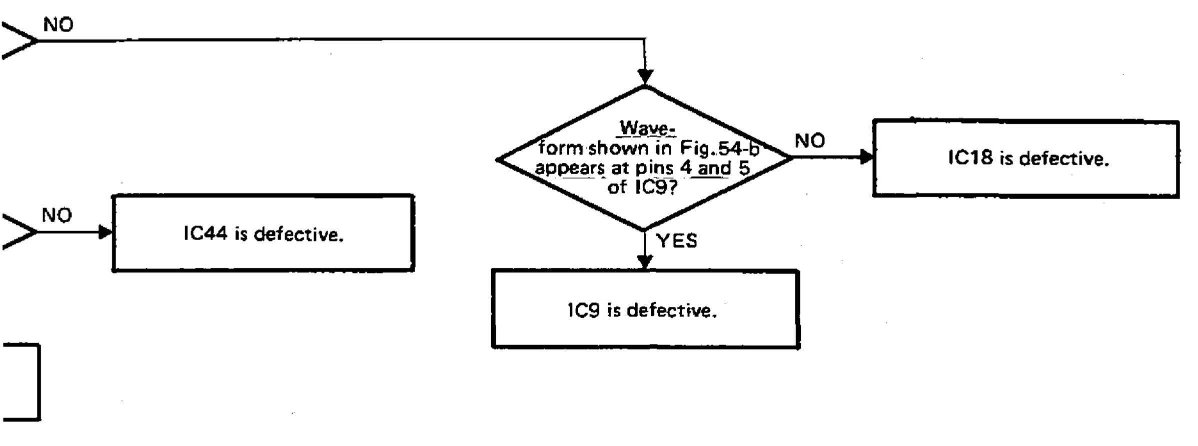

8 µs
20 µs
8 µs
Approx. 4 ms

Fig. 56-b


NO
Wave-form shown in Fig.54-b appears at pins 4 and 5 of IC9?
NO
IC18 is defective.
NO
IC44 is defective.
YES
IC9 is defective.

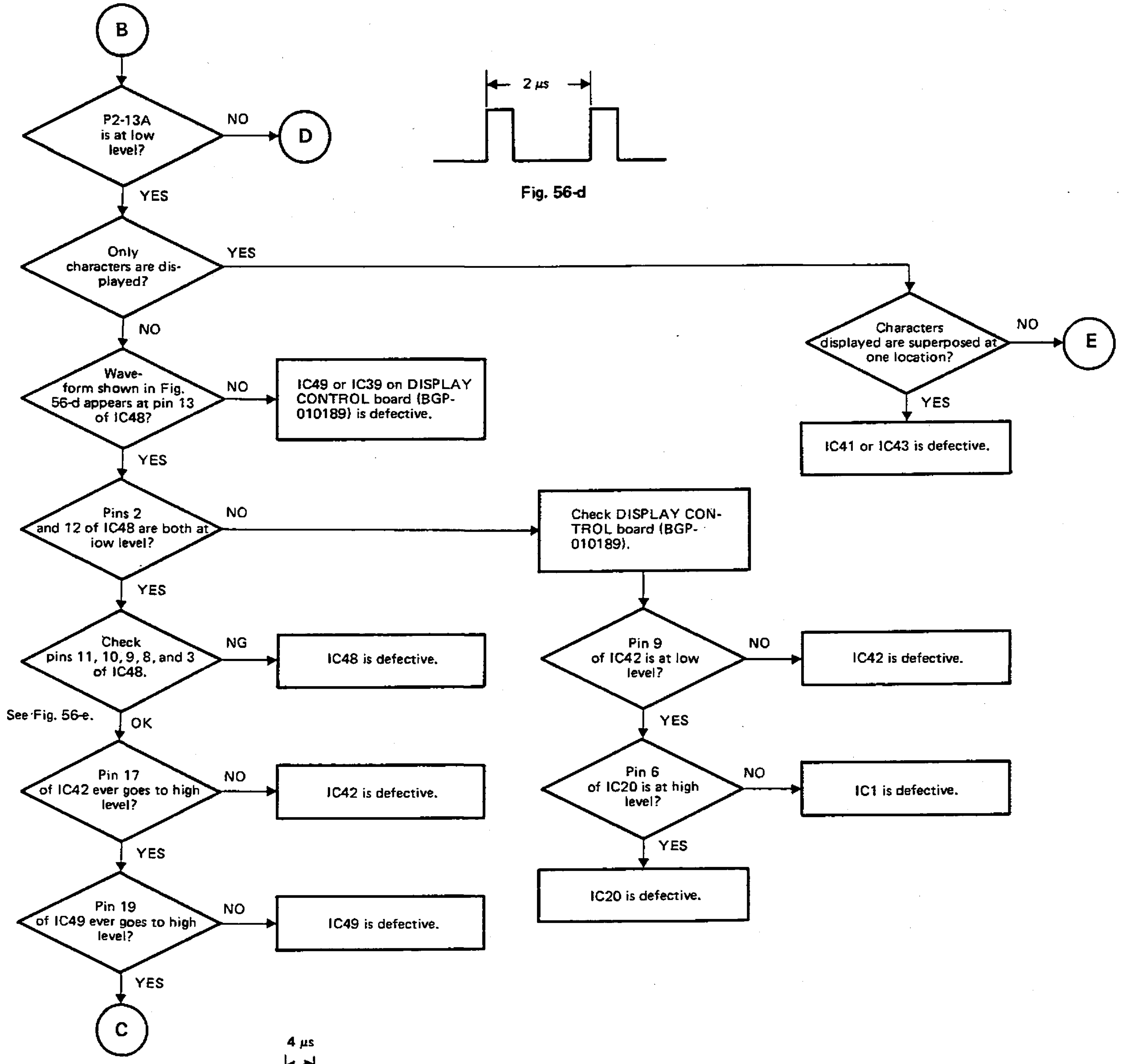
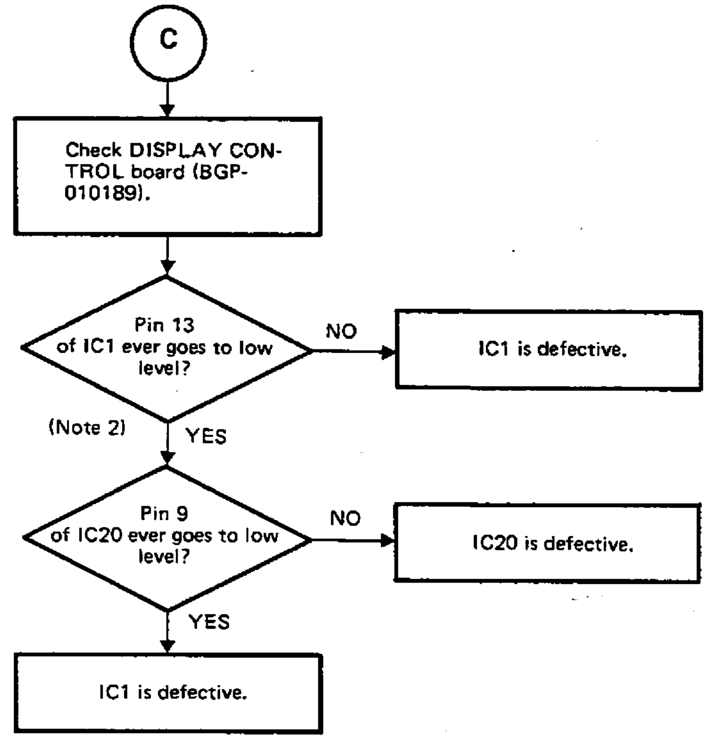


Fig. 56-d



Note 2: Check carefully, since the low-level duration is 500 ns only.

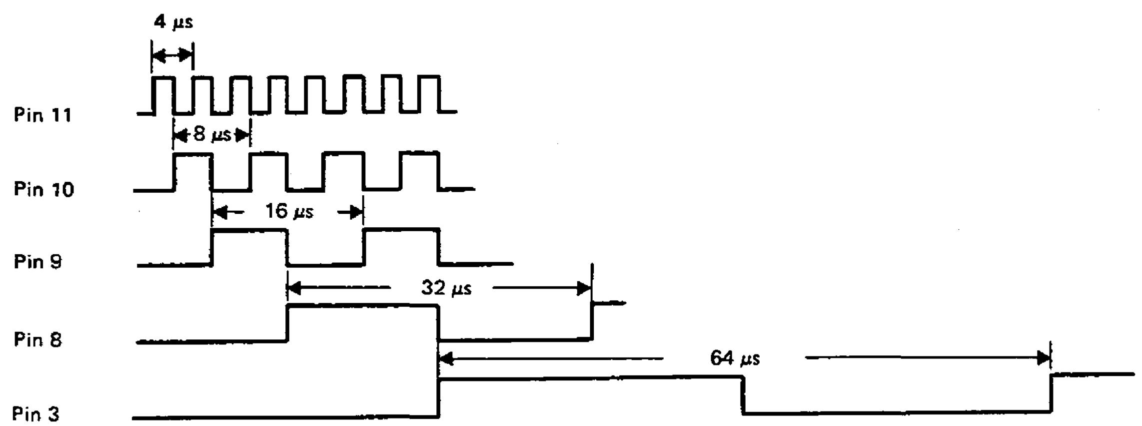
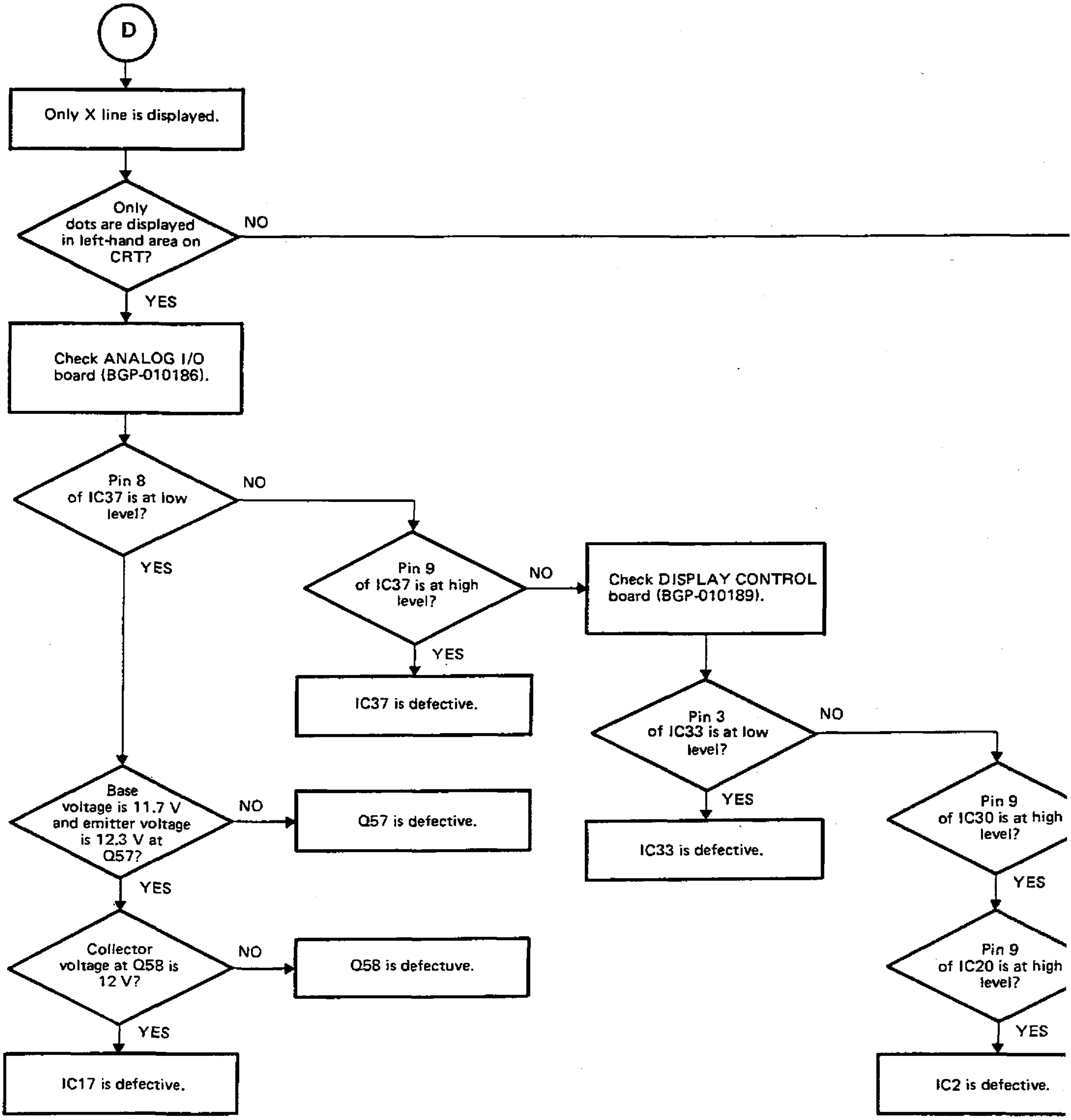
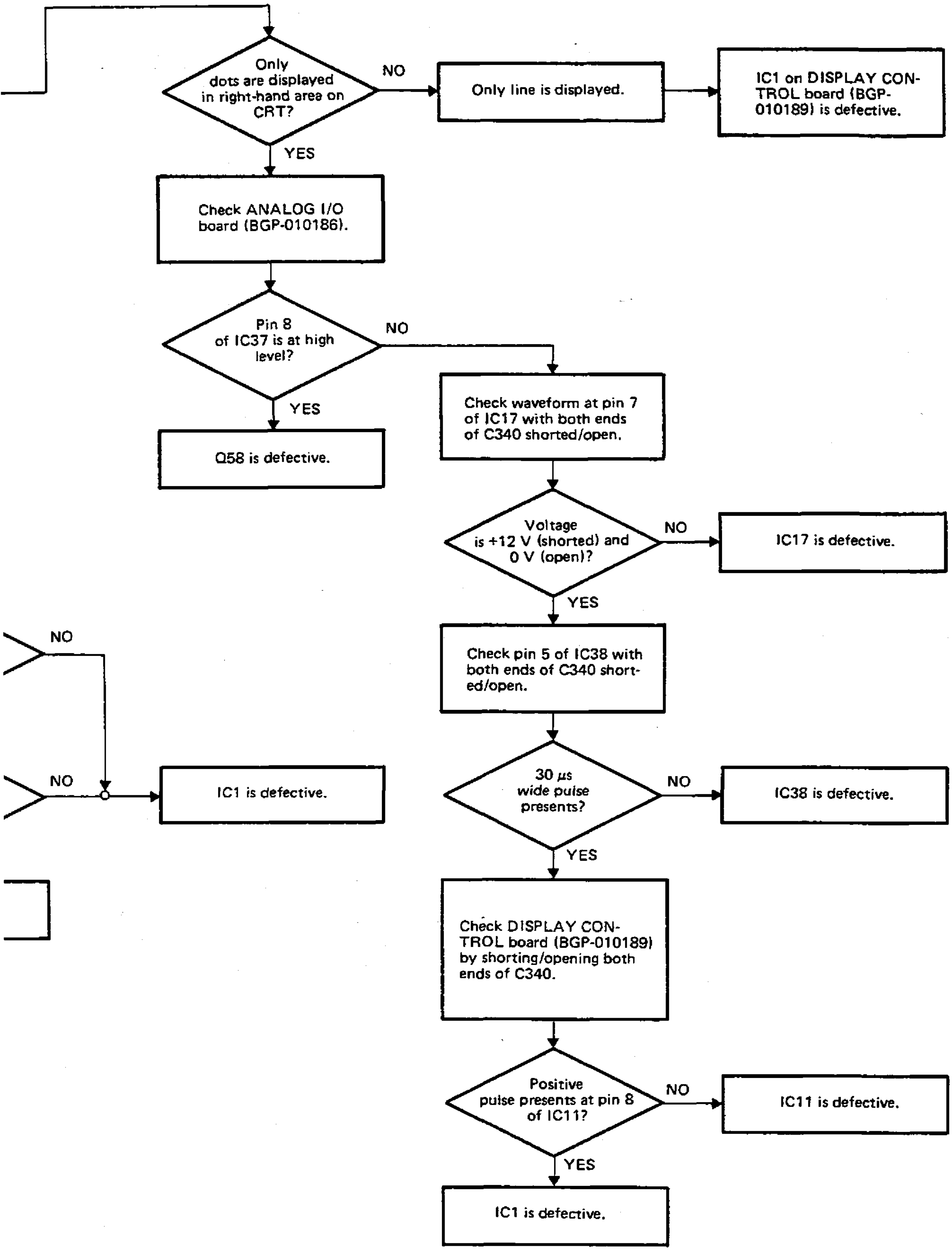
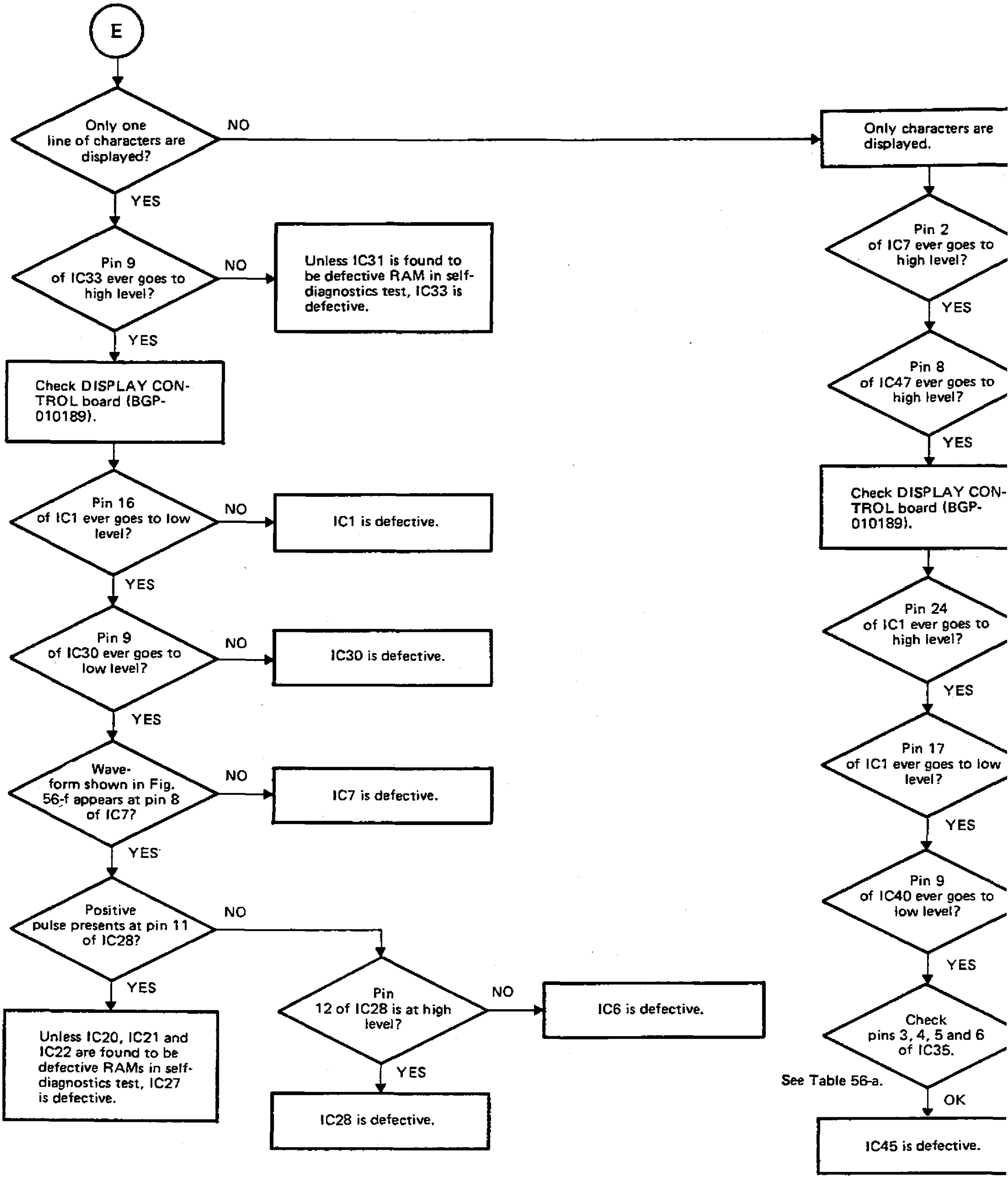


Fig. 56-e


D
Only X line is displayed.
Only dots are displayed in left-hand area on CRT?
NO
YES
Check ANALOG I/O board (BGP-010186).
Pin 8 of IC37 is at low level?
NO
YES
Pin 9 of IC37 is at high level?
NO
Check DISPLAY CONTROL board (BGP-010189).
YES
IC37 is defective.
Pin 3 of IC33 is at low level?
NO
YES
IC33 is defective.
Base voltage is 11.7 V and emitter voltage is 12.3 V at Q57?
NO
Q57 is defective.
YES
Pin 9 of IC30 is at high level?
YES
Collector voltage at Q58 is 12 V?
NO
Q58 is defectuve.
YES
Pin 9 of IC20 is at high level?
YES
IC17 is defective.
IC2 is defective.


Only dots are displayed in right-hand area on CRT?
NO
Only line is displayed.
IC1 on DISPLAY CONTROL board (BGP-010189) is defective.
YES
Check ANALOG I/O board (BGP-010186).
Pin 8 of IC37 is at high level?
NO
YES
Q58 is defective.
Check waveform at pin 7 of IC17 with both ends of C340 shorted/open.
Voltage is +12 V (shorted) and 0 V (open)?
NO
IC17 is defective.
YES
Check pin 5 of IC38 with both ends of C340 shorted/open.
NO
NO
IC1 is defective.
30 μs wide pulse presents?
NO
IC38 is defective.
YES
Check DISPLAY CONTROL board (BGP-010189) by shorting/opening both ends of C340.
Positive pulse presents at pin 8 of IC11?
NO
IC11 is defective.
YES
IC1 is defective.


E
Only one line of characters are displayed?
NO
YES
Pin 9 of IC33 ever goes to high level?
NO
Unless IC31 is found to be defective RAM in self-diagnostics test, IC33 is defective.
YES
Check DISPLAY CONTROL board (BGP-010189).
Pin 16 of IC1 ever goes to low level?
NO
IC1 is defective.
YES
Pin 9 of IC30 ever goes to low level?
NO
IC30 is defective.
YES
Waveform shown in Fig. 56-f appears at pin 8 of IC7?
NO
IC7 is defective.
YES
Positive pulse presents at pin 11 of IC28?
NO
YES
Unless IC20, IC21 and IC22 are found to be defective RAMs in self-diagnostics test, IC27 is defective.
Pin 12 of IC28 is at high level?
NO
IC6 is defective.
YES
IC28 is defective.
Only characters are displayed.
Pin 2 of IC7 ever goes to high level?
YES
Pin 8 of IC47 ever goes to high level?
YES
Check DISPLAY CONTROL board (BGP-010189).
Pin 24 of IC1 ever goes to high level?
YES
Pin 17 of IC1 ever goes to low level?
YES
Pin 9 of IC40 ever goes to low level?
YES
Check pins 3, 4, 5 and 6 of IC35.
See Table 56-a.
OK
IC45 is defective.

NO

Unless IC20 and IC21 are found to be defective RAMs in selfdiagnostics test, IC7 is defective.

NO

IC47 is defective.

NO

Disconnection between IC47-pin 8 of D-A CONVERTER board and IC1-pin 24 of DISPLAY CONTROL board.

NO

IC1 is defective.

NO

IC40 is defective.

NG

Check Display Control RAM.

CHART 20

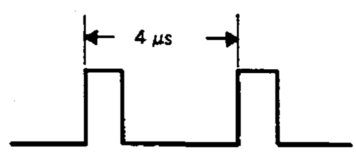
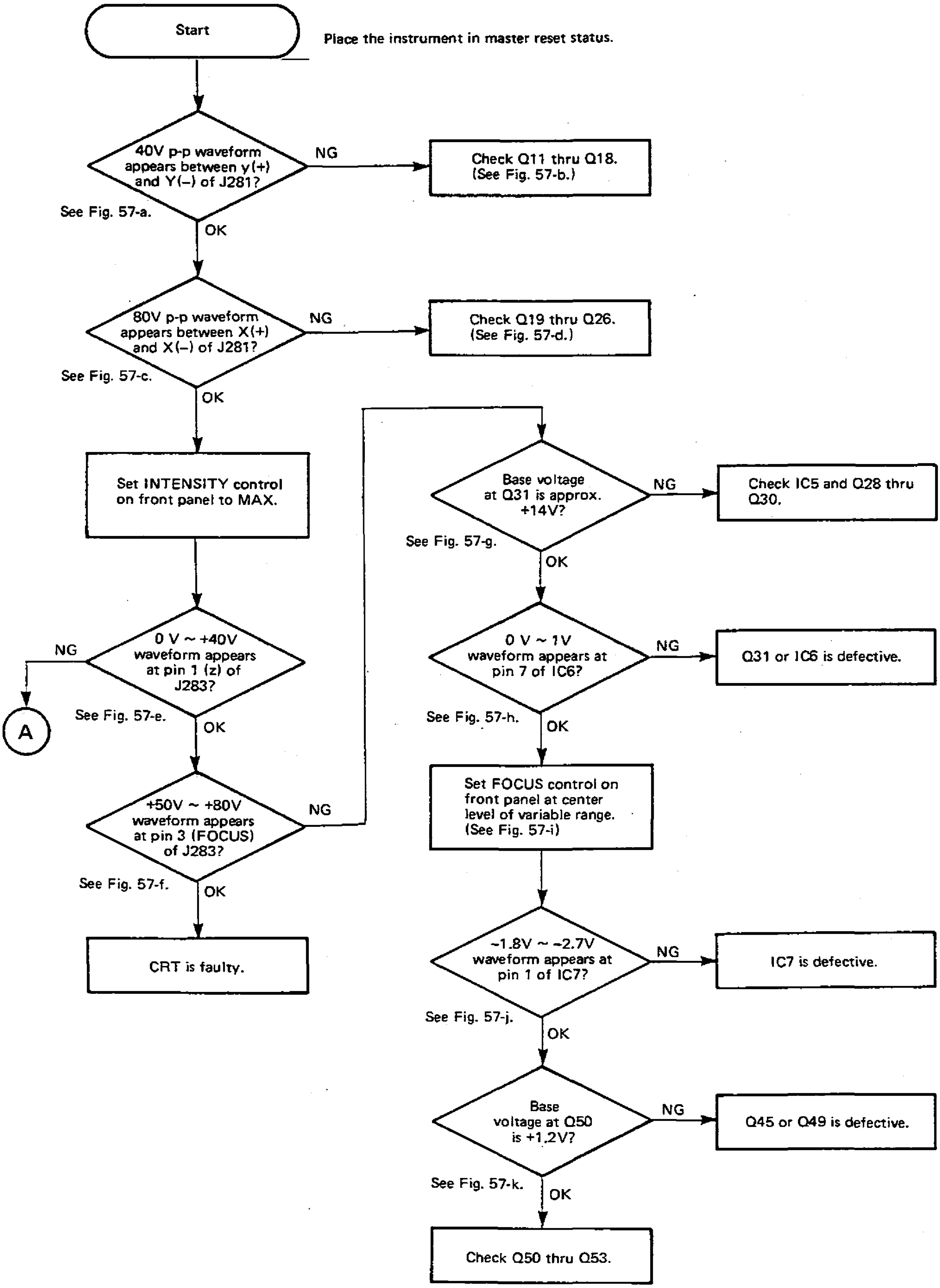


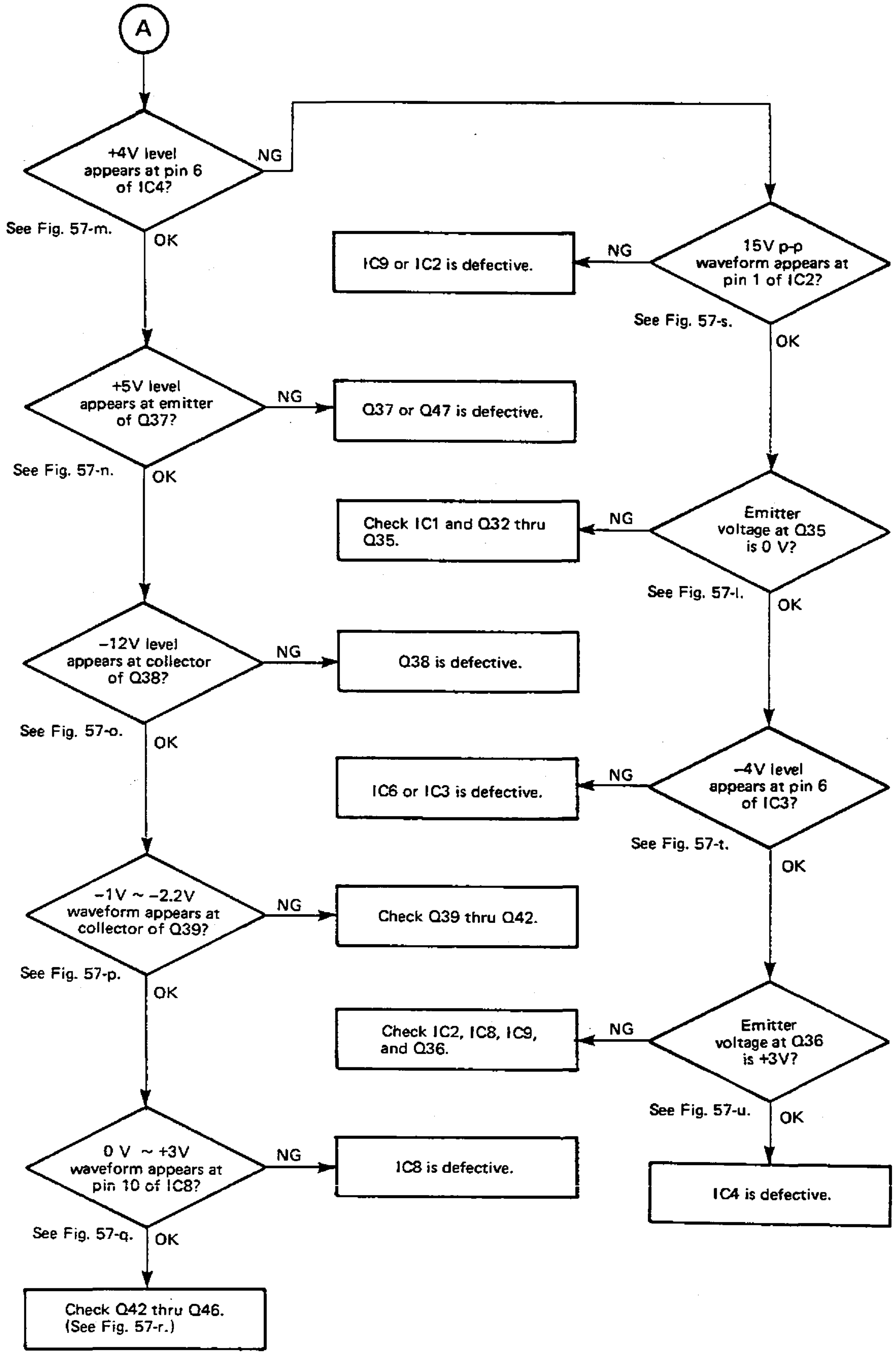
Fig. 56-f

Table 56-a

Pin No.	3	4	5	6
Output	1	1	1	0
	HI	HI	HI	LO

CHART 57 CRT Driver




A
+4V level appears at pin 6 of IC4?
NG
See Fig. 57-m.
OK
15V p-p waveform appears at pin 1 of IC2?
NG
IC9 or IC2 is defective.
See Fig. 57-s.
OK
+5V level appears at emitter of Q37?
NG
Q37 or Q47 is defective.
See Fig. 57-n.
OK
Emitter voltage at Q35 is 0 V?
NG
Check IC1 and Q32 thru Q35.
See Fig. 57-l.
OK
−12V level appears at collector of Q38?
NG
Q38 is defective.
See Fig. 57-o.
OK
−4V level appears at pin 6 of IC3?
NG
IC6 or IC3 is defective.
See Fig. 57-t.
OK
−1V ~ −2.2V waveform appears at collector of Q39?
NG
Check Q39 thru Q42.
See Fig. 57-p.
OK
Emitter voltage at Q36 is +3V?
NG
Check IC2, IC8, IC9, and Q36.
See Fig. 57-u.
OK
IC4 is defective.
0 V ~ +3V waveform appears at pin 10 of IC8?
NG
IC8 is defective.
See Fig. 57-q.
OK
Check Q42 thru Q46. (See Fig. 57-r.)

CRT Driver

Check waveform in master reset status.

Y IN
(17AB)

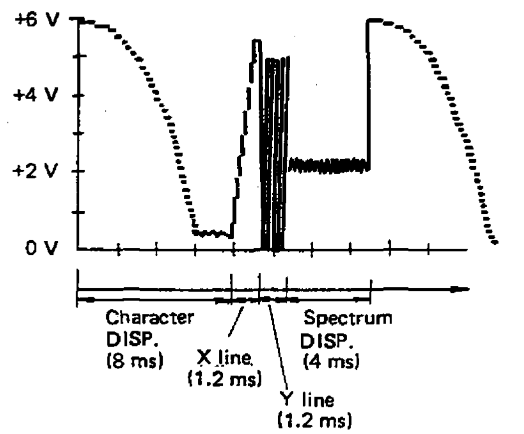


Fig. 57-a

Y + OUT
J281 (Pin 5)

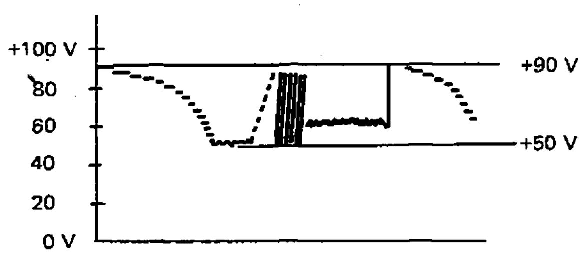


Fig. 57-a

Y - OUT
J281 (Pin 4)

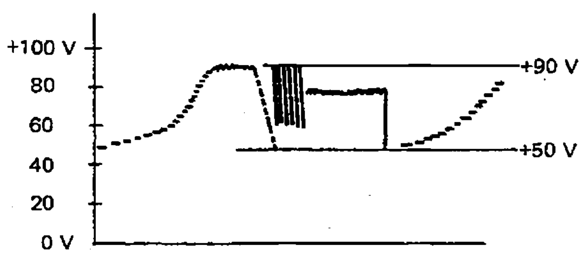


Fig. 57-a

Q13
(Collector)

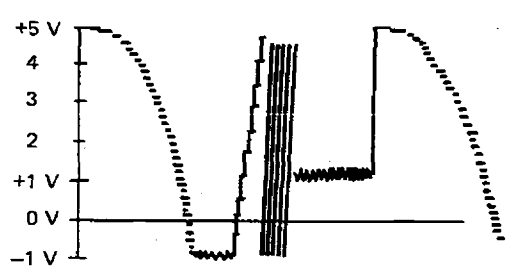


Fig. 57-b

Q14
(Collector)

Fig. 57-b

Q13, Q14
(Base)

Fig. 57-b

Q11, Q12
(Collector)

Fig. 57-b

X IN
(11 AB)

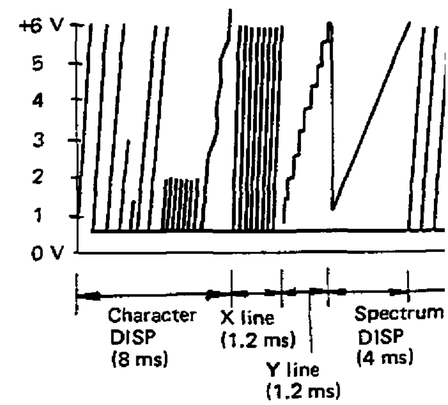


Fig. 57-c

X + OUT
J281 (Pin 2)

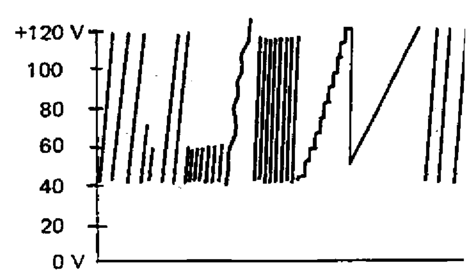


Fig. 57-c

X - OUT
J281 (Pin 1)

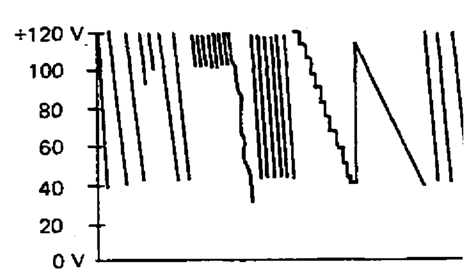


Fig. 57-c

Q21
(Collector)

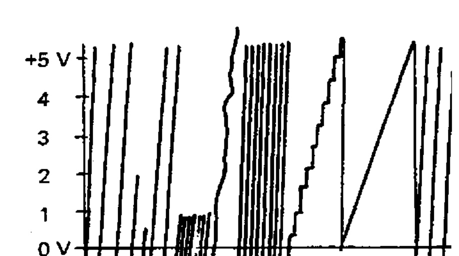


Fig. 57-d

Fig. 57-d

Fig. 57-d

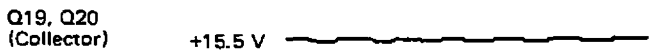


Fig. 57-d

+0.5 V

Fig. 57-e

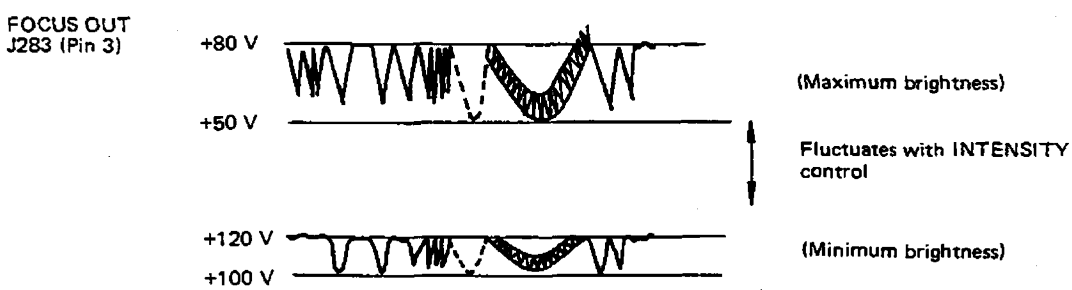


Fig. 57-f

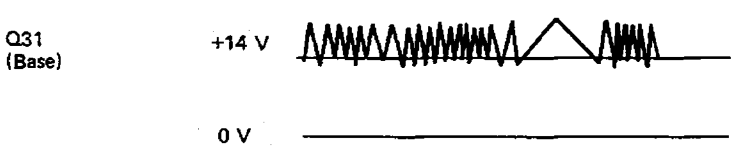


Fig. 57-g

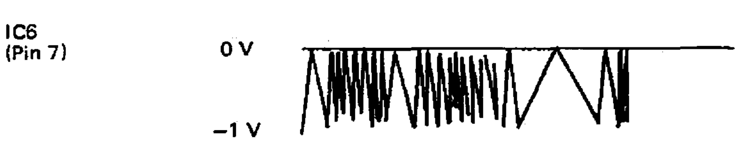


Fig. 57-h

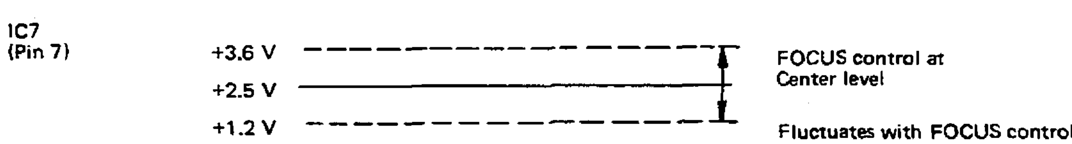


Fig. 57-i

Fig. 57-j

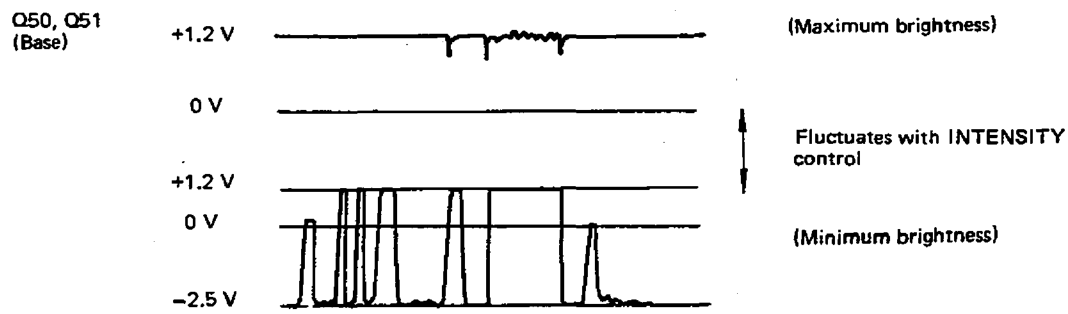


Fig. 57-k

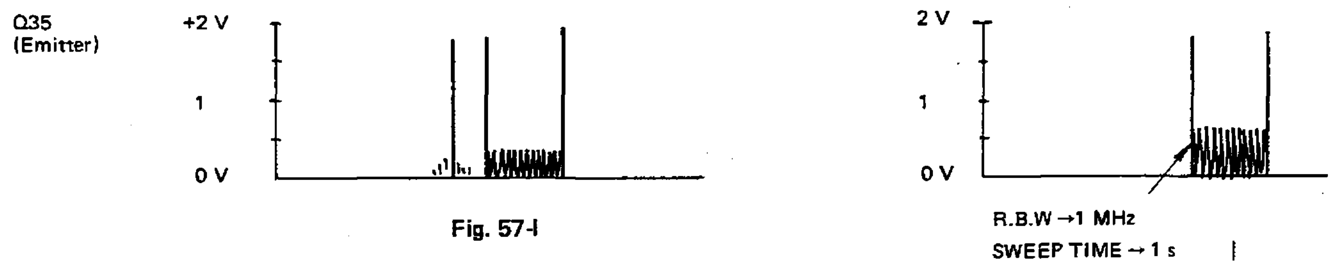


Fig. 57-l

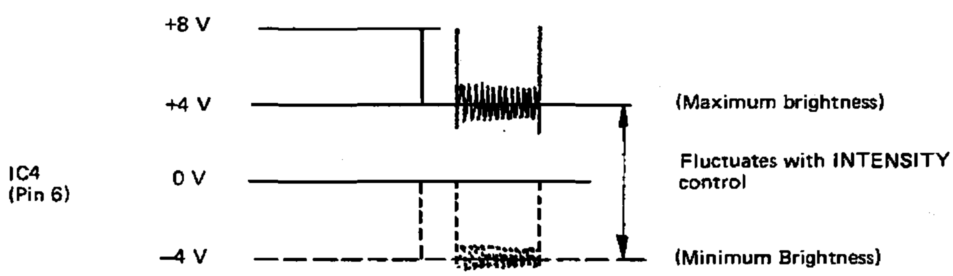


Fig. 57-m

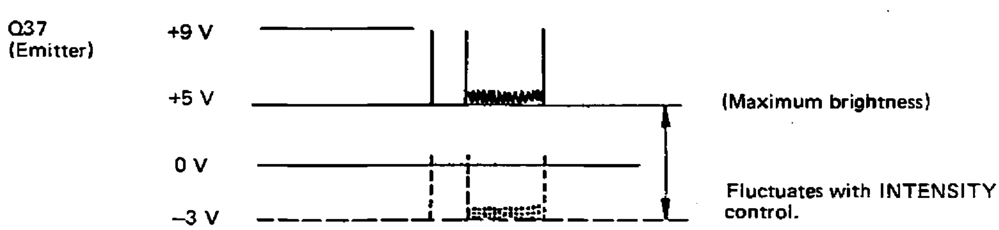


Fig. 57-n

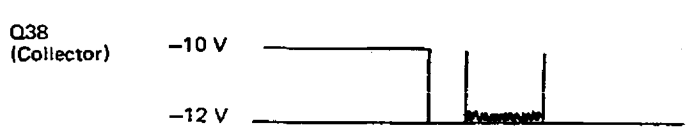


Fig. 57-o̅

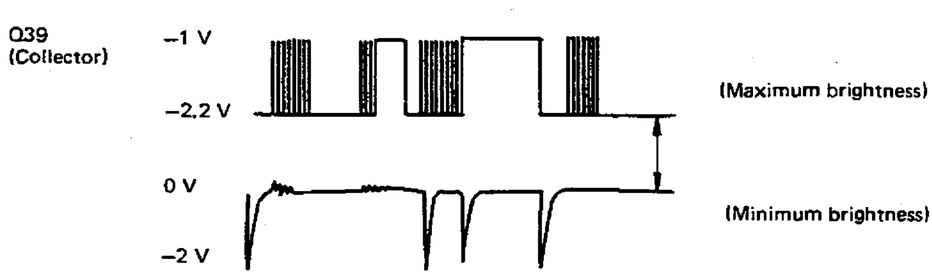


Fig. 57-p

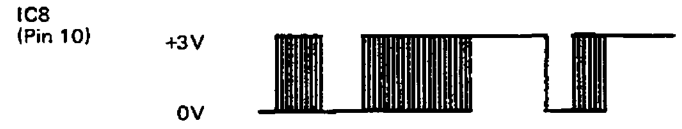


Fig. 57-q

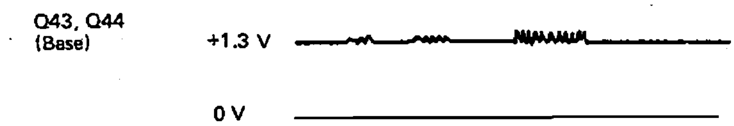


Fig. 57-r

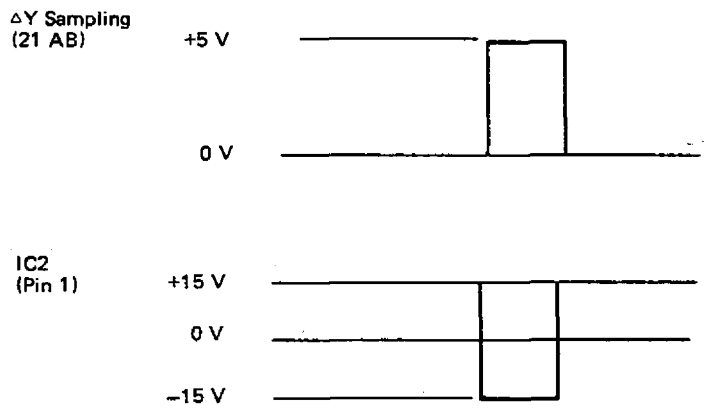


Fig. 57-s

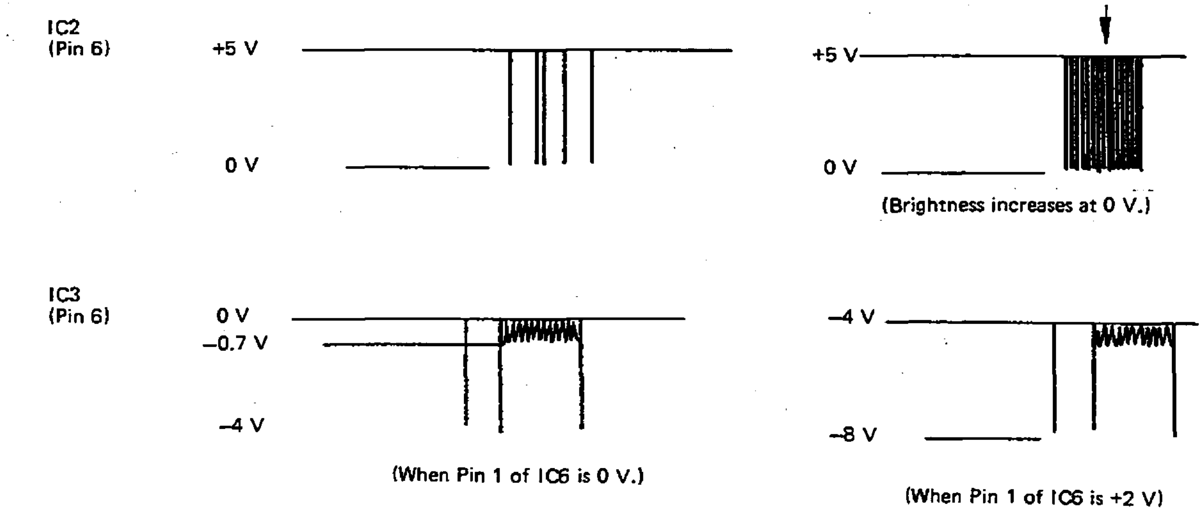


Fig. 57-t

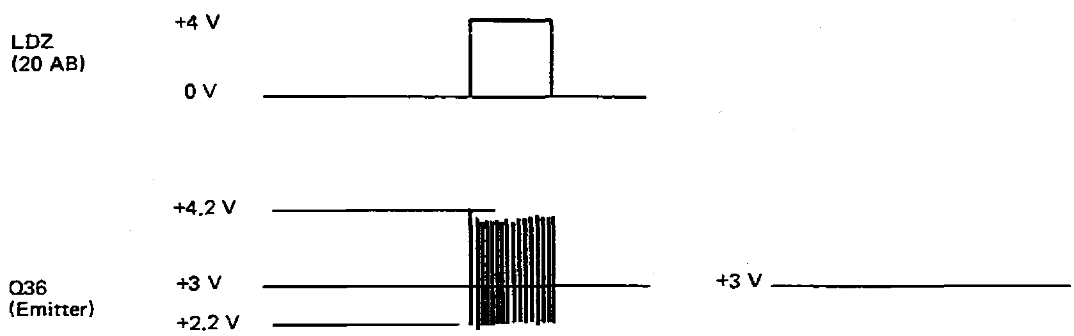
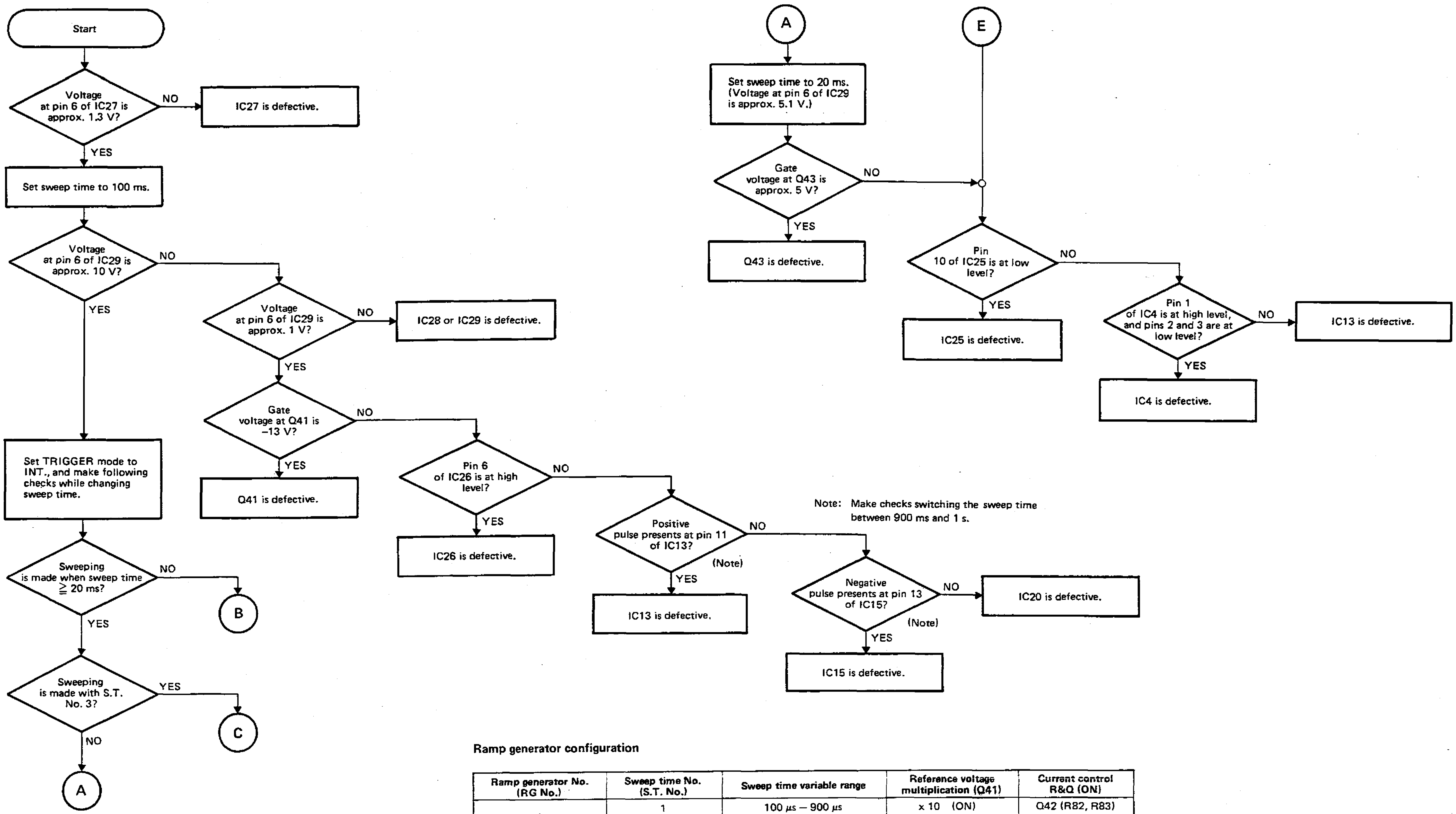


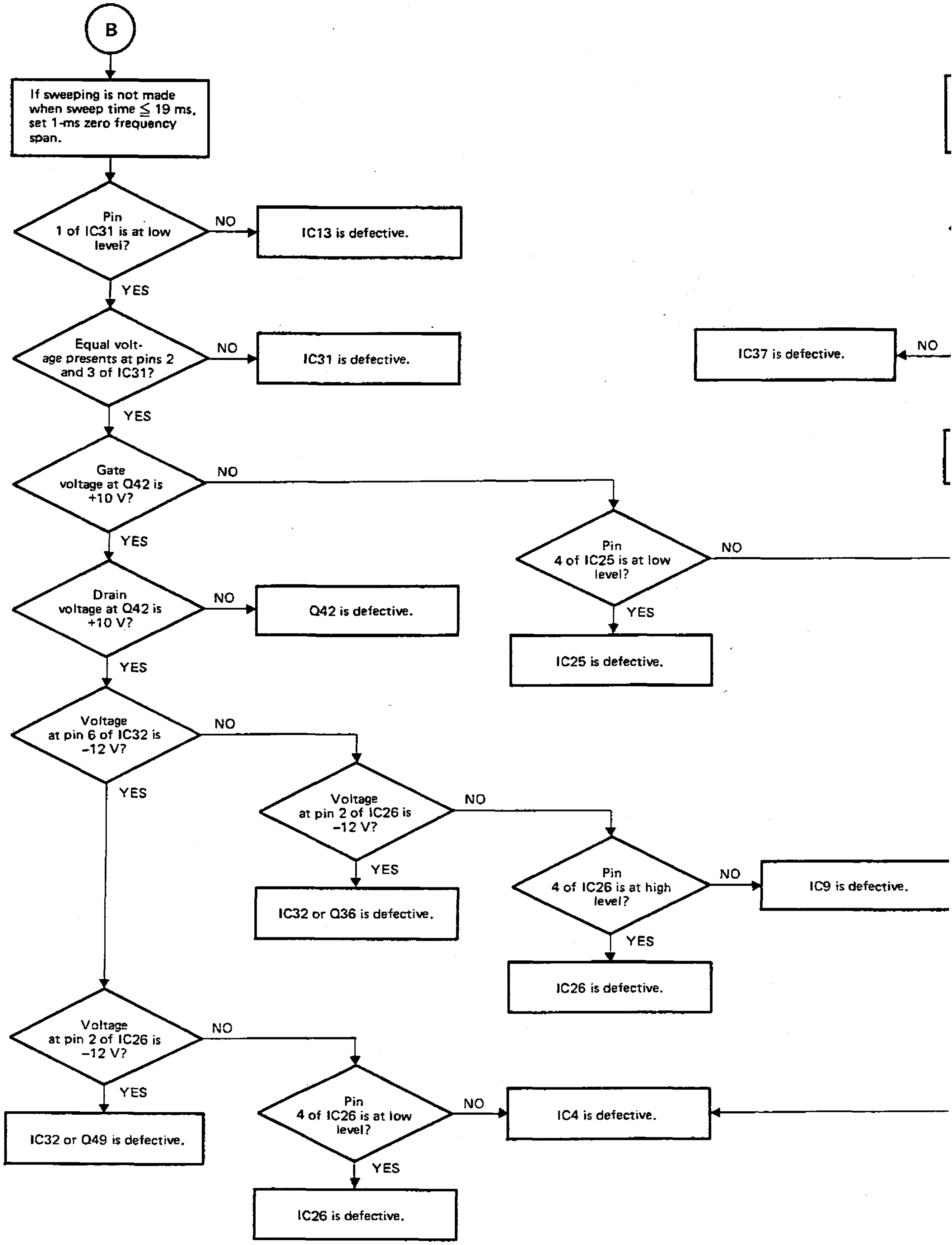
Fig. 57-u

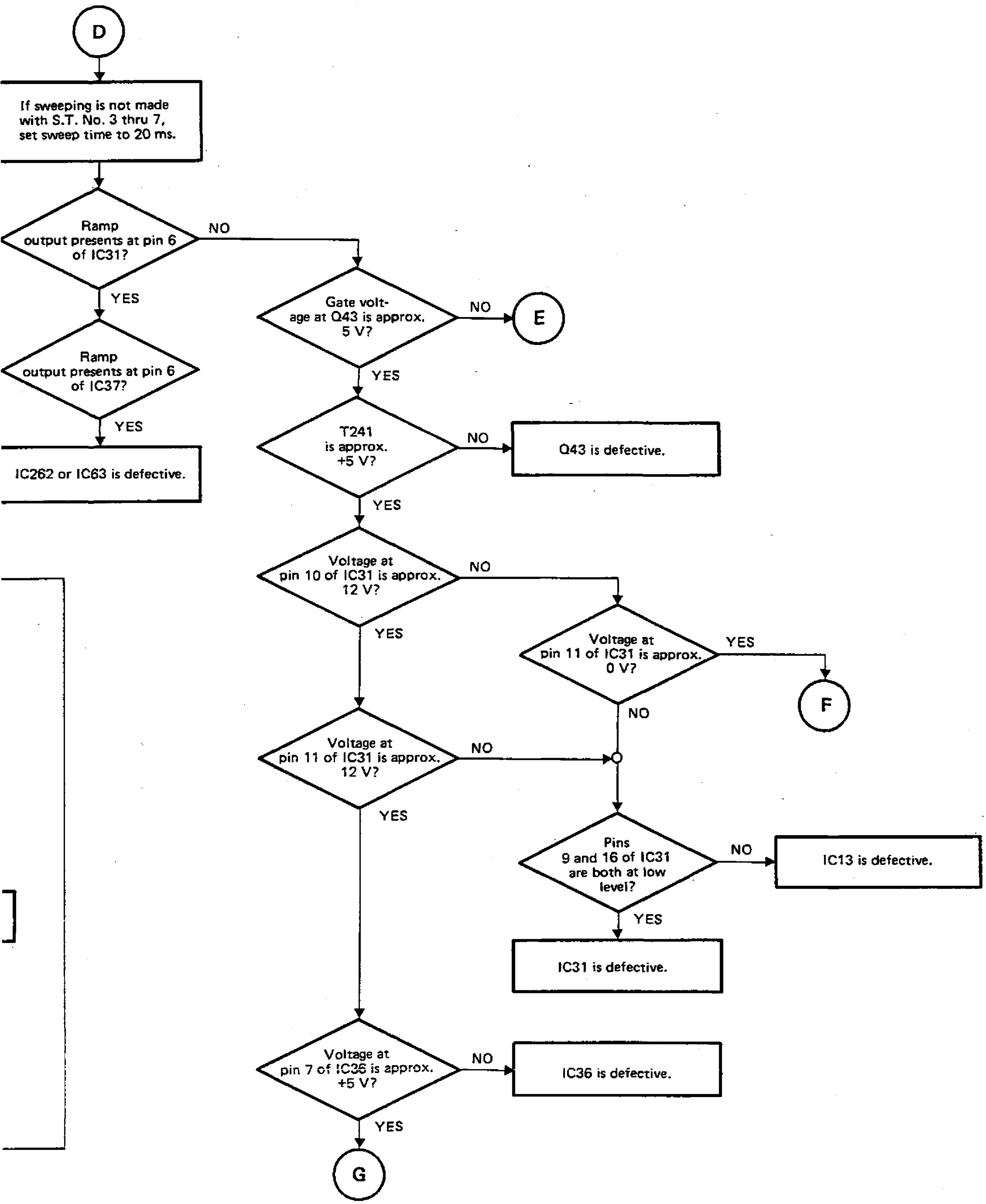
CHART 58 Ramp Generator

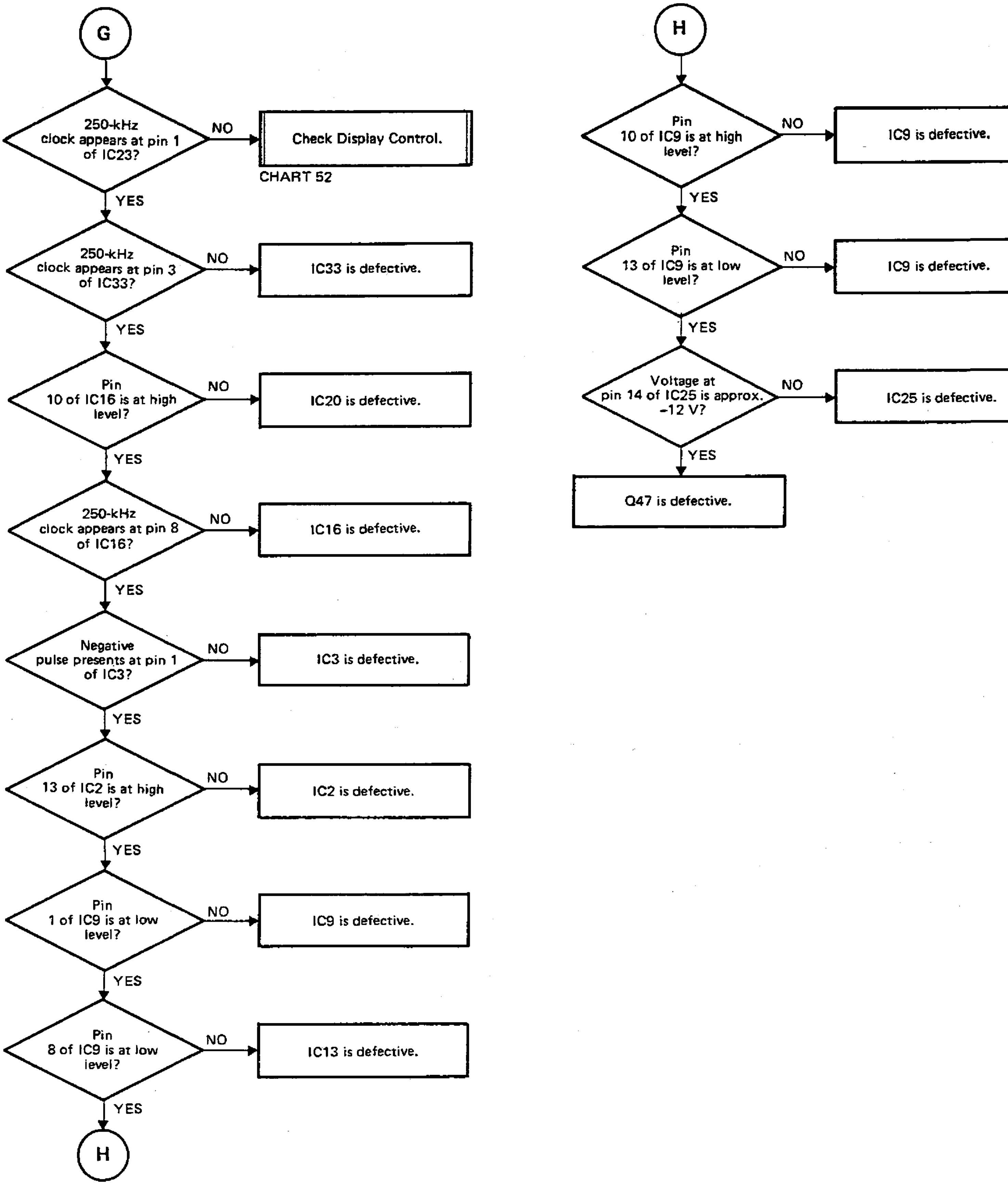


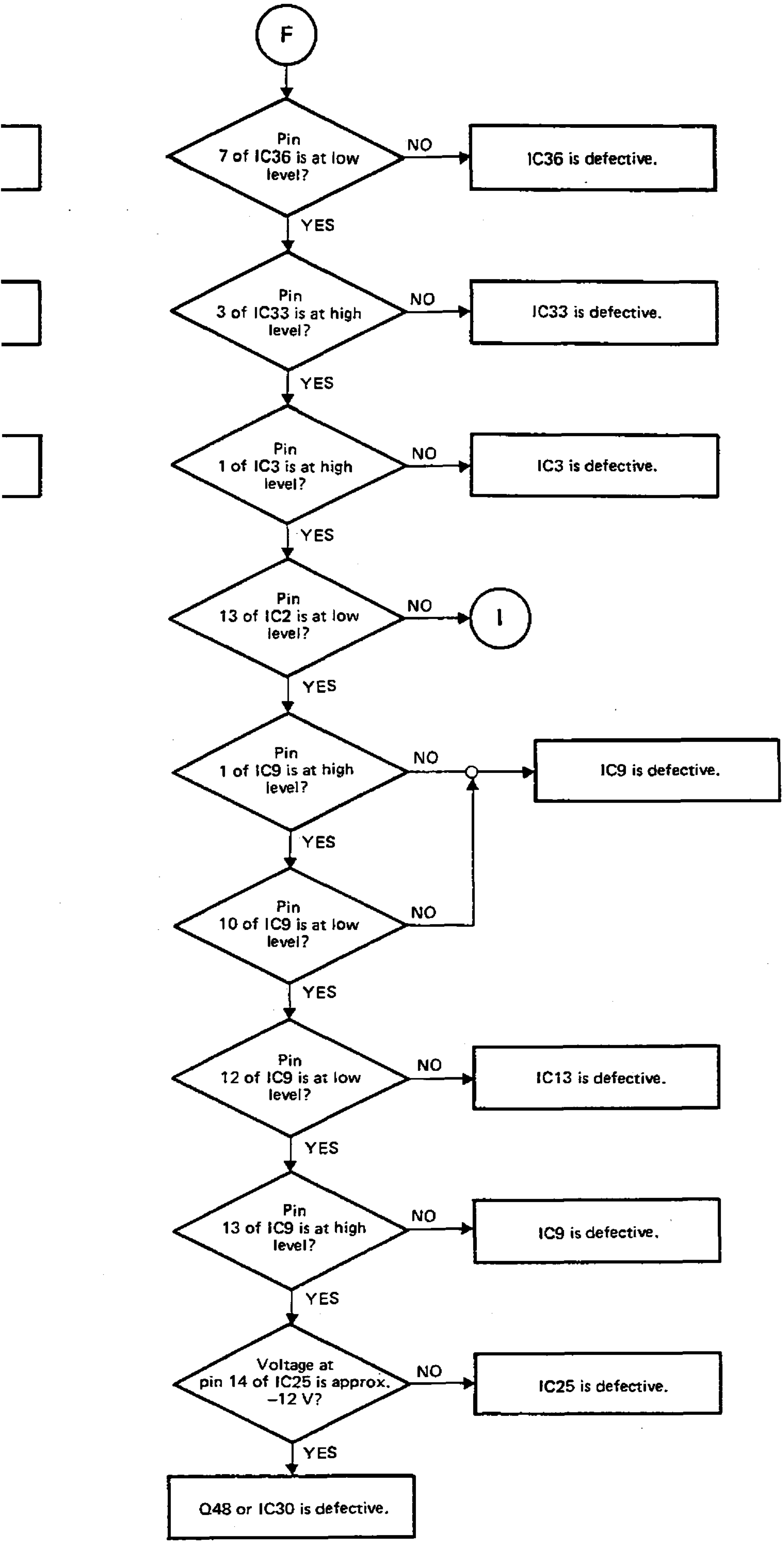
Ramp generator configuration

Ramp generator No. (RG No.)	Sweep time No. (S.T. No.)	Sweep time variable range	Reference voltage multiplication (Q41)	Current control R&Q (ON)
1	1	100 μs – 900 μs	x 10 (ON)	Q42 (R82, R83)
	2	1 ms – 9 ms	x 1 (OFF)	Q42 (R82, R83)
2	3	10 ms – 90 ms	x 10 (ON)	Q43 (R84)
	4	100 ms – 900 ms	x 10 (ON)	Q44 (R85)
	5	1 s – 9 s	x 1 (OFF)	Q44 (R85)
	6	10 s – 90 s	x 10 (ON)	Q45 (R86)
	7	100 s – 1000 s	x 1 (OFF)	Q45 (R86)


B
If sweeping is not made when sweep time ≤ 19 ms, set 1-ms zero frequency span.
Pin 1 of IC31 is at low level?
NO
IC13 is defective.
YES
Equal voltage presents at pins 2 and 3 of IC31?
NO
IC31 is defective.
YES
Gate voltage at Q42 is +10 V?
NO
Pin 4 of IC25 is at low level?
NO
YES
IC25 is defective.
IC37 is defective.
NO
YES
Drain voltage at Q42 is +10 V?
NO
Q42 is defective.
YES
Voltage at pin 6 of IC32 is −12 V?
NO
Voltage at pin 2 of IC26 is −12 V?
NO
Pin 4 of IC26 is at high level?
NO
IC9 is defective.
YES
IC26 is defective.
YES
IC32 or Q36 is defective.
YES
Voltage at pin 2 of IC26 is −12 V?
NO
Pin 4 of IC26 is at low level?
NO
IC4 is defective.
YES
IC26 is defective.
YES
IC32 or Q49 is defective.


D
If sweeping is not made with S.T. No. 3 thru 7, set sweep time to 20 ms.
Ramp output presents at pin 6 of IC31?
NO
YES
Ramp output presents at pin 6 of IC37?
YES
IC262 or IC63 is defective.
Gate voltage at Q43 is approx. 5 V?
NO
E
YES
T241 is approx. +5 V?
NO
Q43 is defective.
YES
Voltage at pin 10 of IC31 is approx. 12 V?
NO
Voltage at pin 11 of IC31 is approx. 0 V?
YES
F
NO
YES
Voltage at pin 11 of IC31 is approx. 12 V?
NO
YES
Pins 9 and 16 of IC31 are both at low level?
NO
IC13 is defective.
YES
IC31 is defective.
Voltage at pin 7 of IC36 is approx. +5 V?
NO
IC36 is defective.
YES
G


G
250-kHz clock appears at pin 1 of IC23?
NO
Check Display Control.
CHART 52
YES
250-kHz clock appears at pin 3 of IC33?
NO
IC33 is defective.
YES
Pin 10 of IC16 is at high level?
NO
IC20 is defective.
YES
250-kHz clock appears at pin 8 of IC16?
NO
IC16 is defective.
YES
Negative pulse presents at pin 1 of IC3?
NO
IC3 is defective.
YES
Pin 13 of IC2 is at high level?
NO
IC2 is defective.
YES
Pin 1 of IC9 is at low level?
NO
IC9 is defective.
YES
Pin 8 of IC9 is at low level?
NO
IC13 is defective.
YES
H
H
Pin 10 of IC9 is at high level?
NO
IC9 is defective.
YES
Pin 13 of IC9 is at low level?
NO
IC9 is defective.
YES
Voltage at pin 14 of IC25 is approx. -12 V?
NO
IC25 is defective.
YES
Q47 is defective.


F
Pin 7 of IC36 is at low level?
NO
IC36 is defective.
YES
Pin 3 of IC33 is at high level?
NO
IC33 is defective.
YES
Pin 1 of IC3 is at high level?
NO
IC3 is defective.
YES
Pin 13 of IC2 is at low level?
NO
I
YES
Pin 1 of IC9 is at high level?
NO
IC9 is defective.
YES
Pin 10 of IC9 is at low level?
NO
YES
Pin 12 of IC9 is at low level?
NO
IC13 is defective.
YES
Pin 13 of IC9 is at high level?
NO
IC9 is defective.
YES
Voltage at pin 14 of IC25 is approx. −12 V?
NO
IC25 is defective.
YES
Q48 or IC30 is defective.

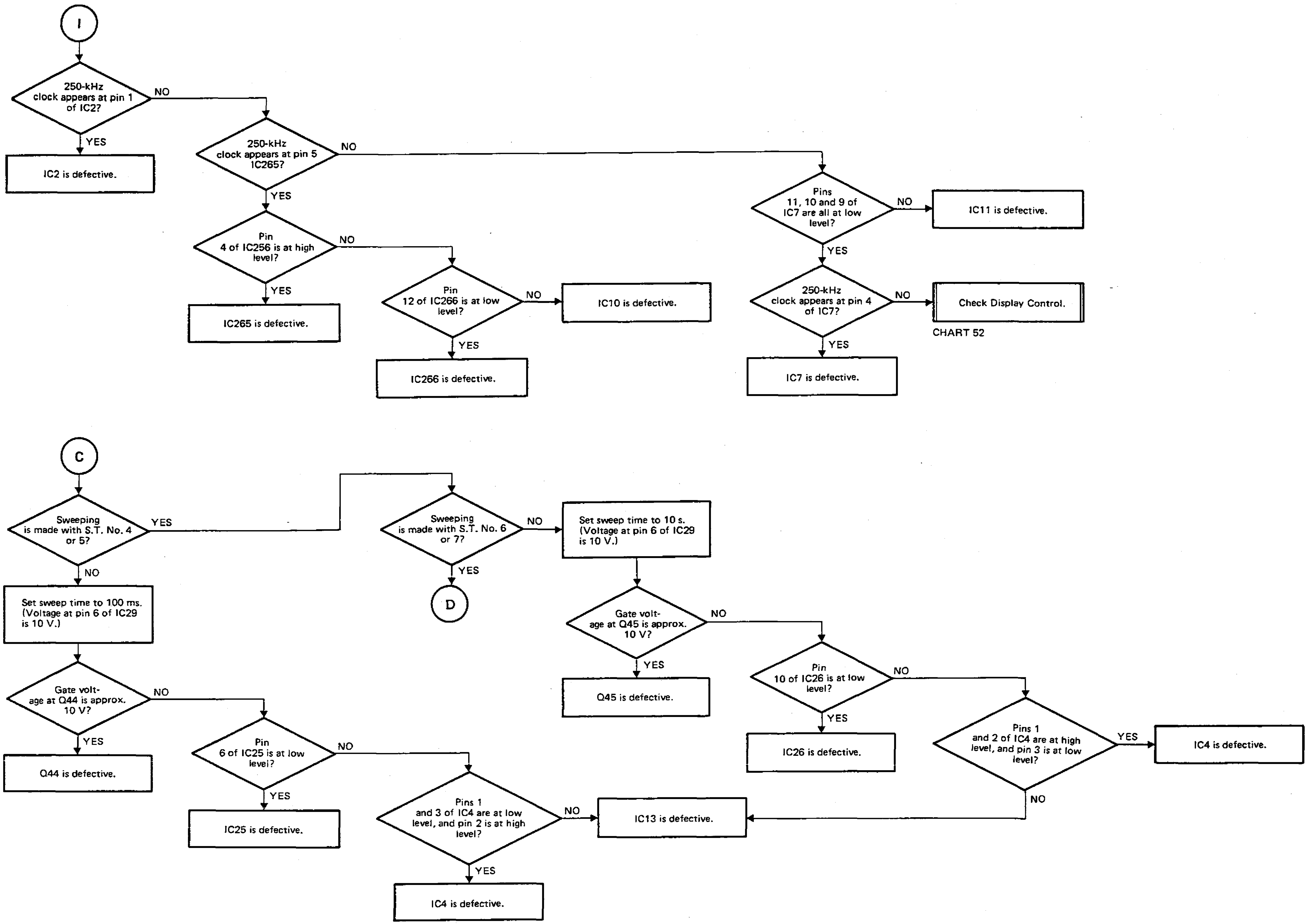
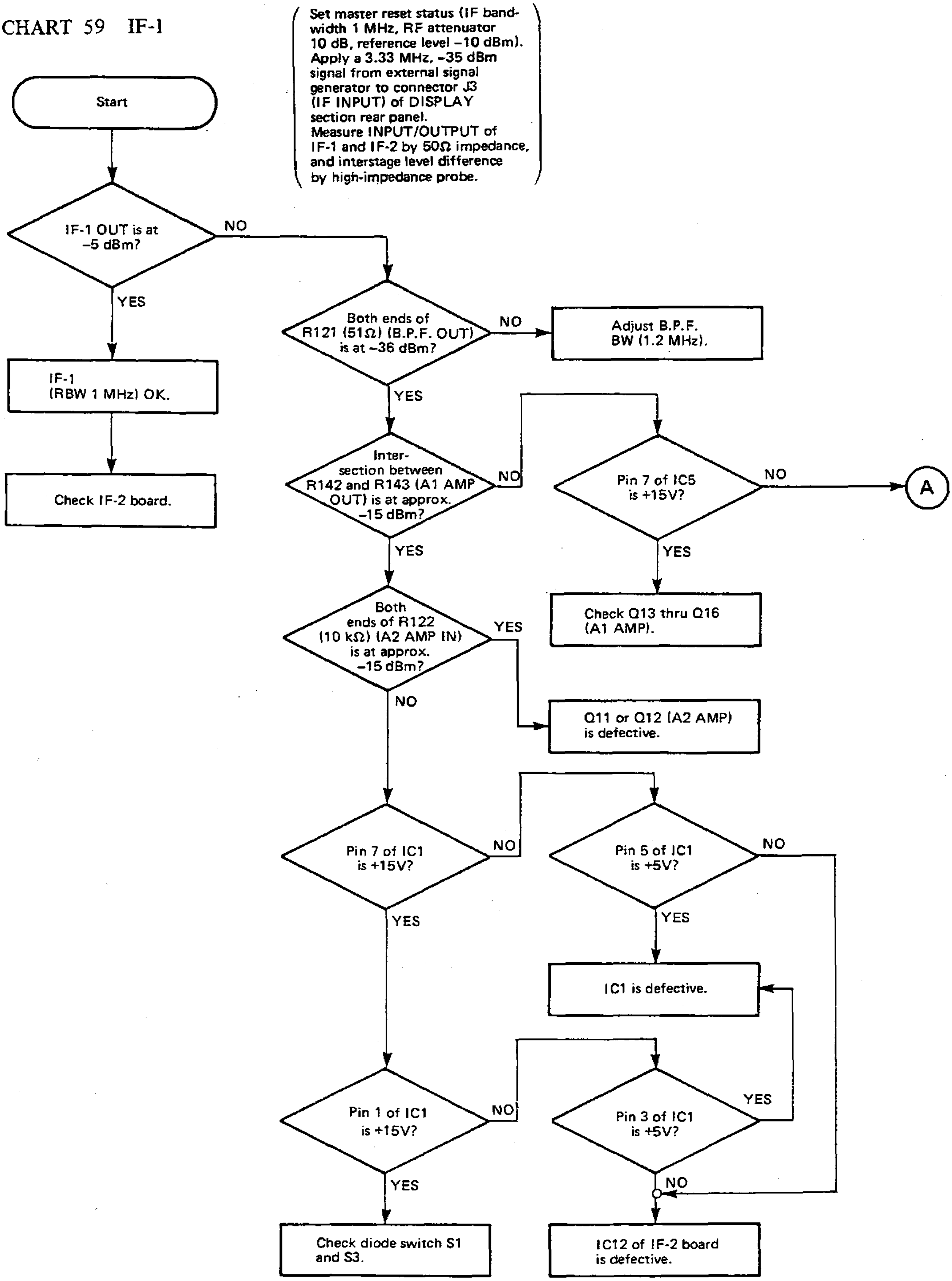
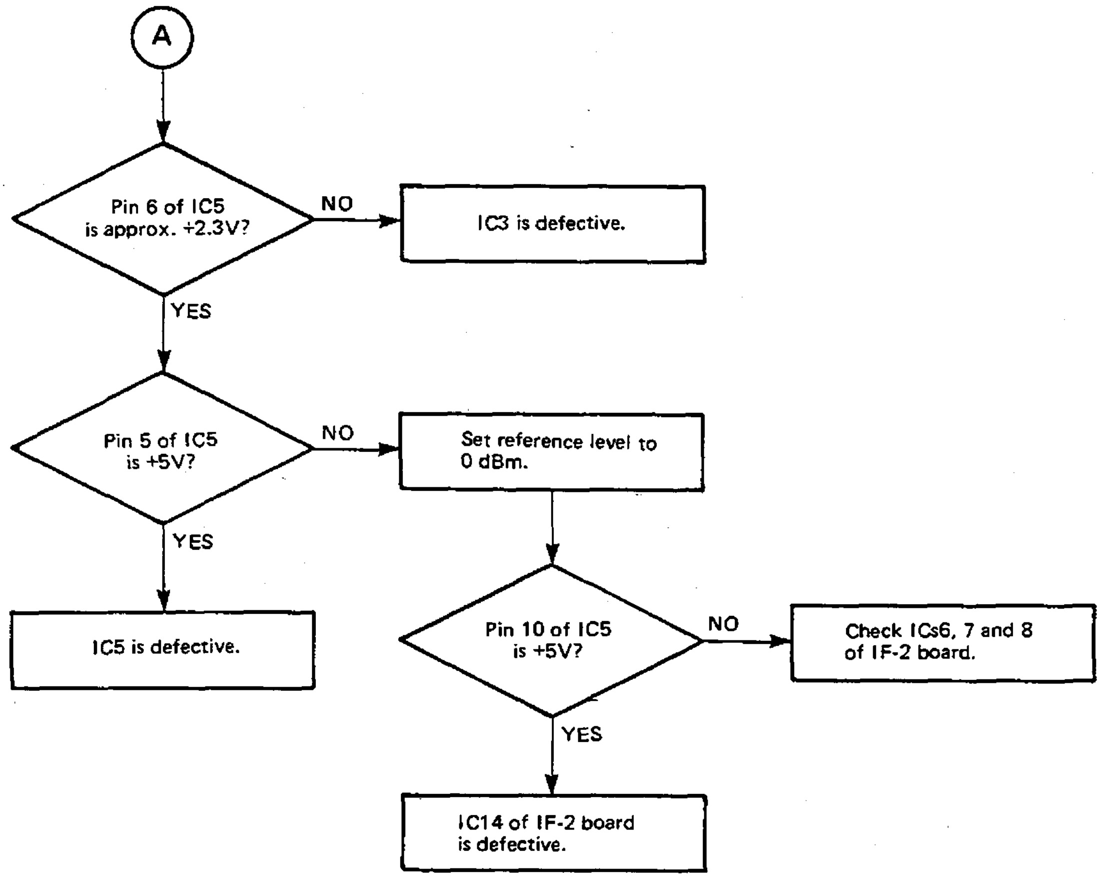

I
250-kHz clock appears at pin 1 of IC2?
NO
YES
IC2 is defective.
250-kHz clock appears at pin 5 IC265?
NO
YES
Pin 4 of IC256 is at high level?
NO
YES
IC265 is defective.
Pin 12 of IC266 is at low level?
NO
IC10 is defective.
YES
IC266 is defective.
Pins 11, 10 and 9 of IC7 are all at low level?
NO
IC11 is defective.
YES
250-kHz clock appears at pin 4 of IC7?
NO
Check Display Control.
CHART 52
YES
IC7 is defective.
C
Sweeping is made with S.T. No. 4 or 5?
YES
NO
Set sweep time to 100 ms. (Voltage at pin 6 of IC29 is 10 V.)
Gate voltage at Q44 is approx. 10 V?
NO
YES
Q44 is defective.
Pin 6 of IC25 is at low level?
NO
YES
IC25 is defective.
Pins 1 and 3 of IC4 are at low level, and pin 2 is at high level?
NO
YES
IC4 is defective.
IC13 is defective.
Sweeping is made with S.T. No. 6 or 7?
NO
YES
D
Set sweep time to 10 s. (Voltage at pin 6 of IC29 is 10 V.)
Gate voltage at Q45 is approx. 10 V?
NO
YES
Q45 is defective.
Pin 10 of IC26 is at low level?
NO
YES
IC26 is defective.
Pins 1 and 2 of IC4 are at high level, and pin 3 is at low level?
YES
IC4 is defective.
NO

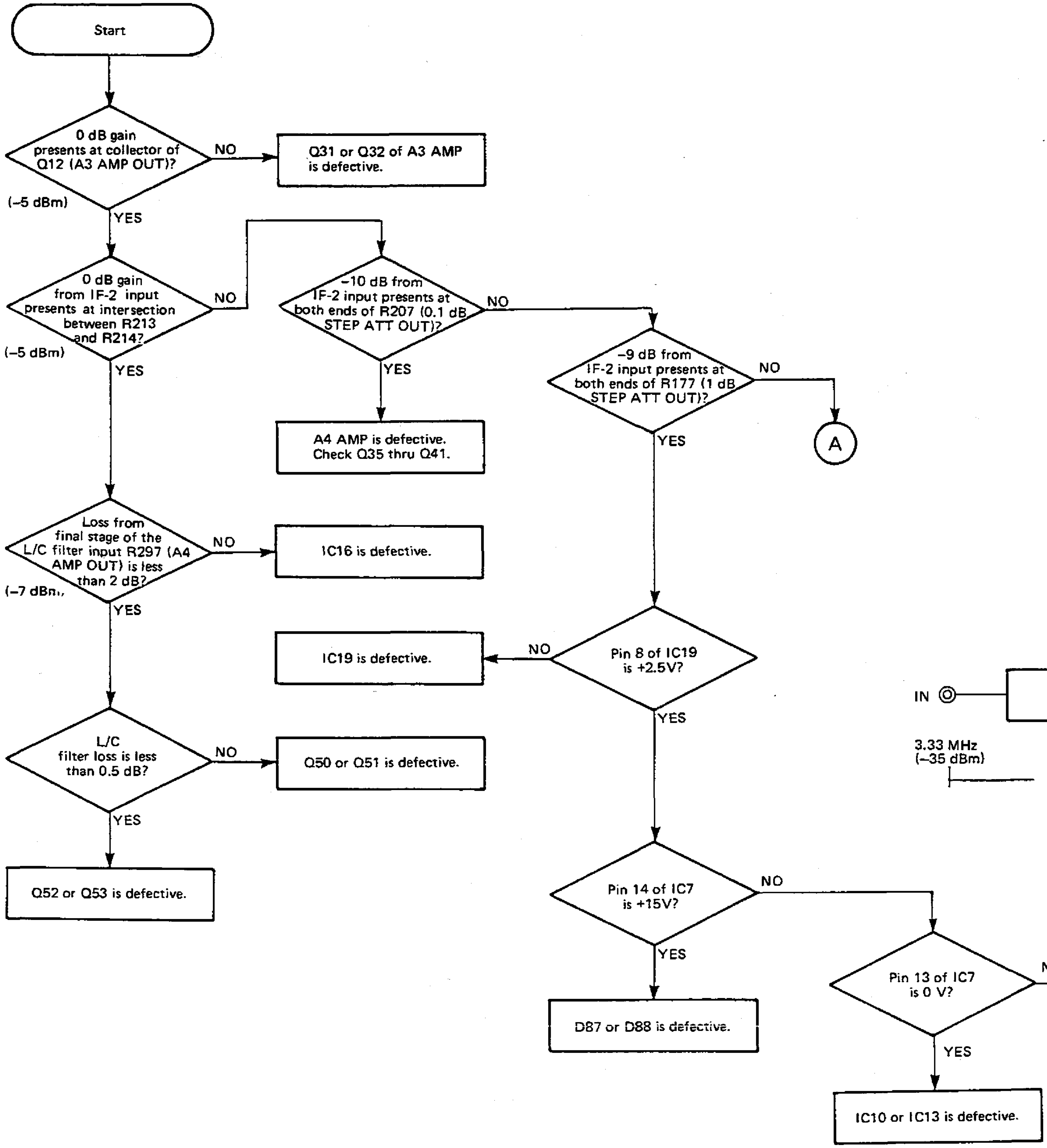
CHART 59 IF-1

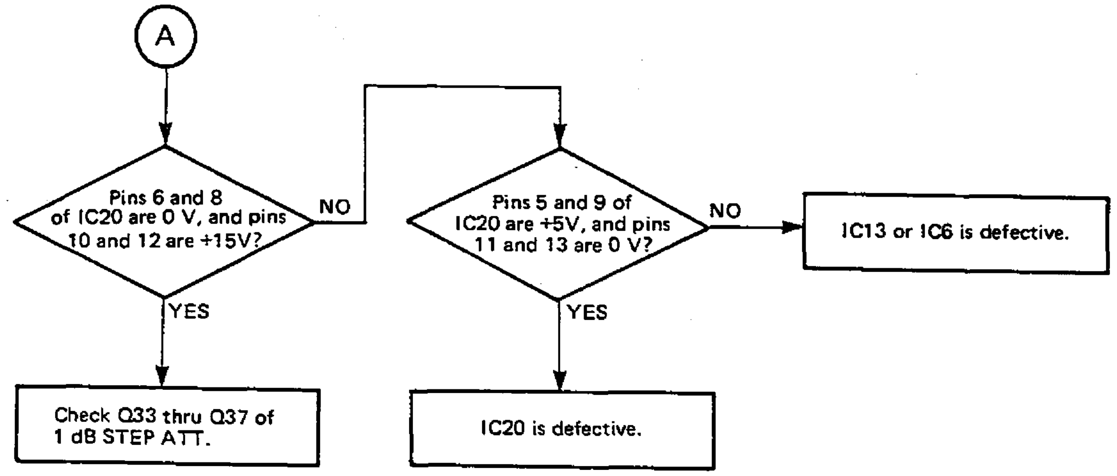

Set master reset status (IF bandwidth 1 MHz, RF attenuator 10 dB, reference level −10 dBm). Apply a 3.33 MHz, −35 dBm signal from external signal generator to connector J3 (IF INPUT) of DISPLAY section rear panel. Measure INPUT/OUTPUT of IF-1 and IF-2 by 50Ω impedance, and interstage level difference by high-impedance probe.
Start
IF-1 OUT is at −5 dBm?
NO
YES
IF-1 (RBW 1 MHz) OK.
Check IF-2 board.
Both ends of R121 (51Ω) (B.P.F. OUT) is at −36 dBm?
NO
Adjust B.P.F. BW (1.2 MHz).
YES
Inter-section between R142 and R143 (A1 AMP OUT) is at approx. −15 dBm?
NO
Pin 7 of IC5 is +15V?
NO
A
YES
Check Q13 thru Q16 (A1 AMP).
YES
Both ends of R122 (10 kΩ) (A2 AMP IN) is at approx. −15 dBm?
YES
Q11 or Q12 (A2 AMP) is defective.
NO
Pin 7 of IC1 is +15V?
NO
Pin 5 of IC1 is +5V?
NO
YES
IC1 is defective.
YES
Pin 1 of IC1 is +15V?
NO
Pin 3 of IC1 is +5V?
YES
NO
YES
Check diode switch S1 and S3.
IC12 of IF-2 board is defective.



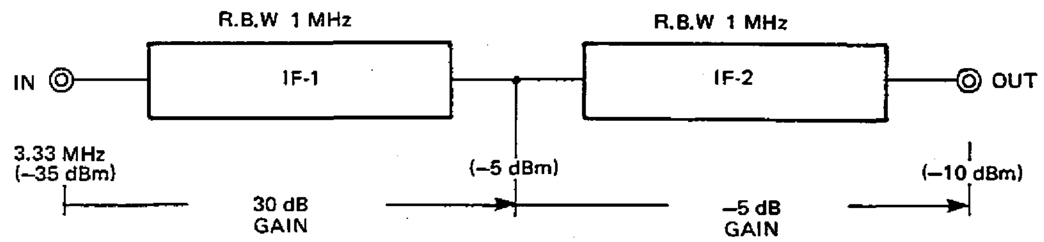
Note: See Fig. 10-16 for B.P.F, A1 AMP and A2 AMP.

CHART 60 IF-2





Note: See Fig. 10-16 for A3 AMP, A4 AMP, 0.1 dB STEP ATT, and 1 dB STEP ATT.



(Master reset status.
R.B.W: 1 MHz
RF ATT: 10 dB
REF LEVEL: −10 dBm)

CHART 61 IF Block RBW

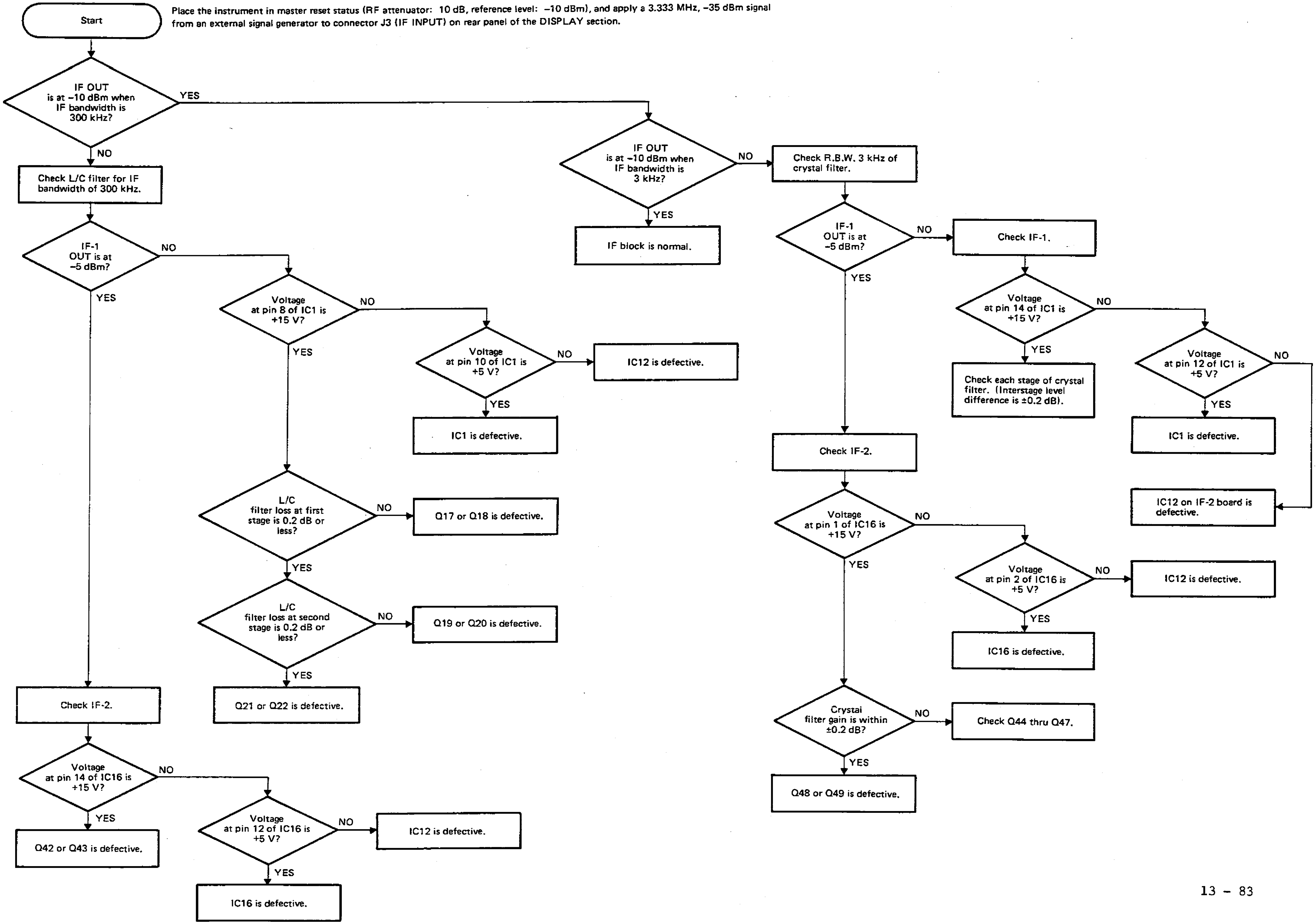
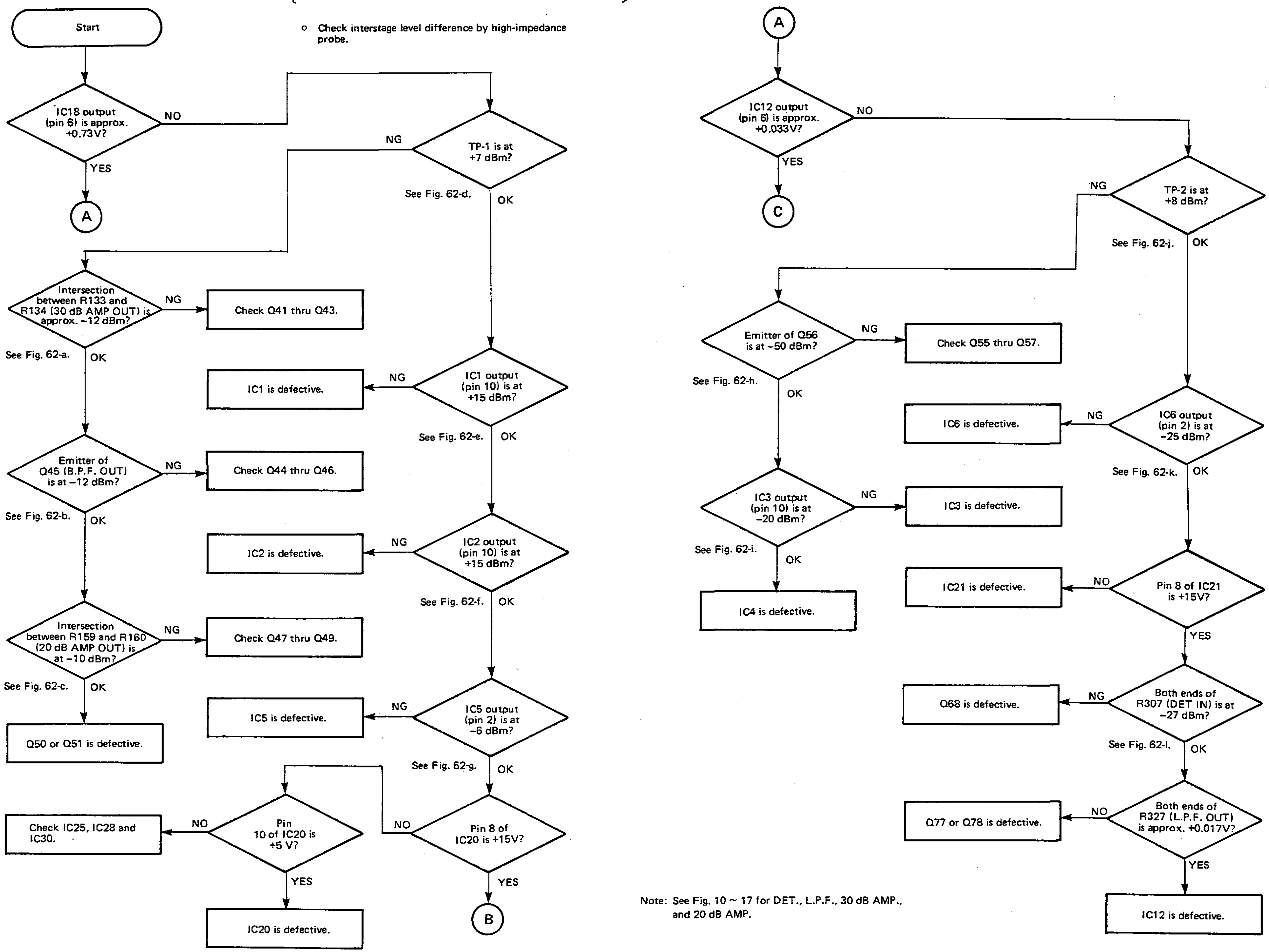


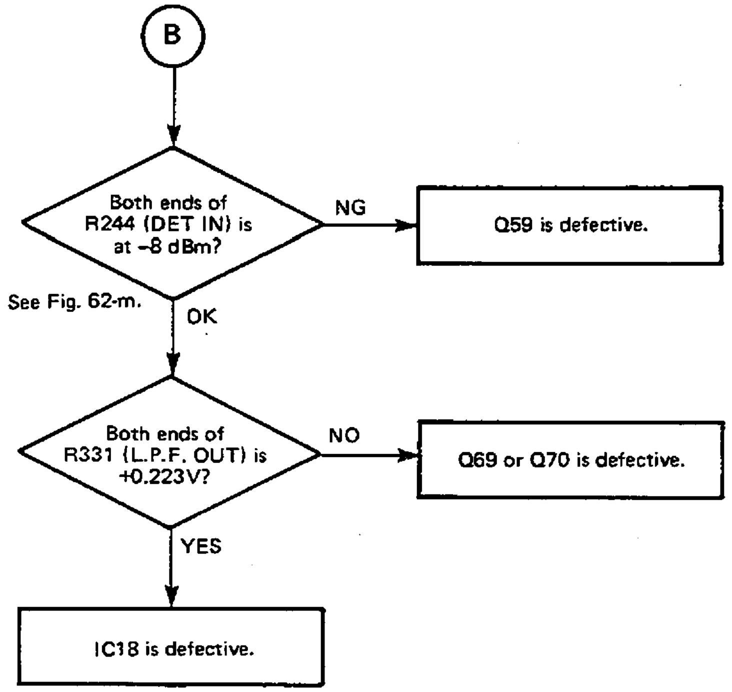
CHART 62 Log Amp.

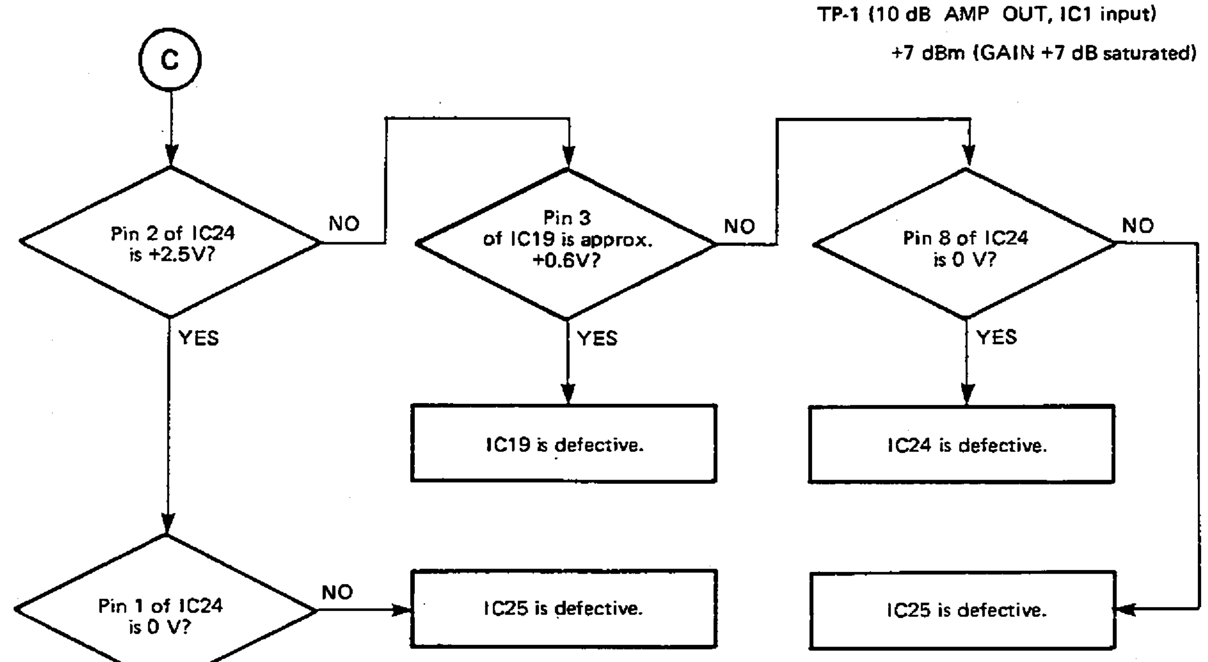
[Master reset status (RF attenuator 10 dB, reference level –10 dBm)
LOG AMP input (3.33 MHz, –50 dBm)]

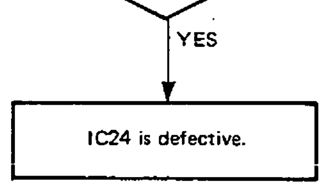
- Check interstage level difference by high-impedance probe.



Note: See Fig. 10 ~ 17 for DET., L.P.F., 30 dB AMP., and 20 dB AMP.







IC1 OUT Pin 10
+15 dBm (Pins 5, 8 and 10 are all saturated.)

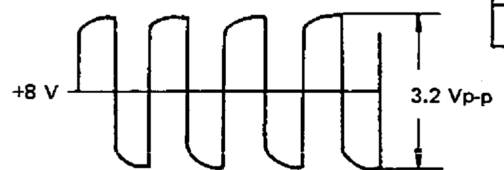


Fig. 62-e

IC2 OUT Pin 10
+15 dBm (Pins 5, 8 and 10 are all saturated.)

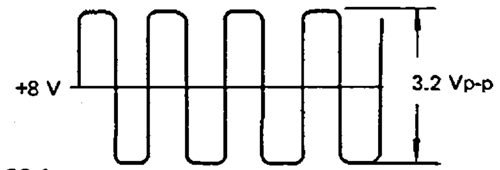


Fig. 62-f

SUM. AMP OUT (IC5, Pin 2)
−6 dBm

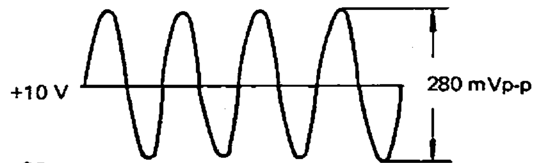


Fig. 62-g

LOG AMP

Waveform, Interstage level difference check

30 dB AMP OUT (intersection between R133 and R134)
−12 dBm (GAIN +28 dB)

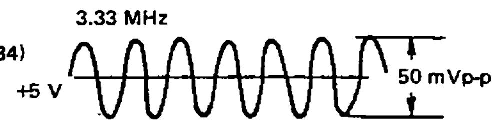


Fig. 62-a

B.P.F OUT (Q45 emitter)
−12 dBm (GAIN 0 dB)

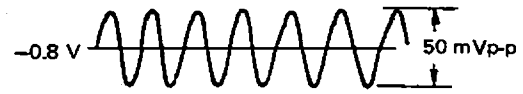


Fig. 62-b

20 dB AMP OUT (intersection between R159 and R160)
+10 dBm (GAIN +22 dB)

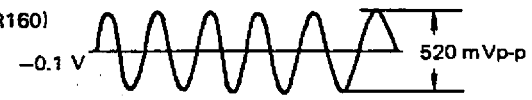


Fig. 62-c

TP-1 (10 dB AMP OUT, IC1 input)
+7 dBm (GAIN +7 dB saturated)

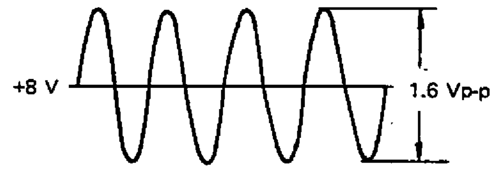


Fig. 62-d

LOG AMP Output Voltage

LOG AMP Input	LOG AMP Output Voltage
0 [dBm]	+5.00 [V]
−10	+4.50
−20	+4.00
−30	+3.50
−40	+3.00
−50	+2.50
−60	+2.00
−70	+1.50
−80	+1.00
−90	+0.50
−100	+0.00

B.P.F OUT (Q56 emitter)
−50 dBm (GAIN 0 dB)

Fig. 62-h

IC3 OUT (Pin 10)
−20 dBm (GAIN 30 dB)

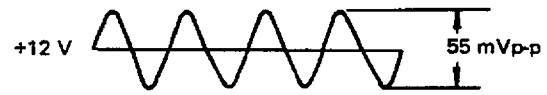


Fig. 62-i

TP-2 (IC4 OUT)
+8 dBm (GAIN 28 dB saturated)

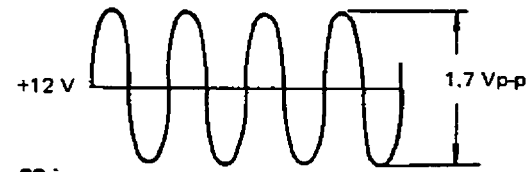


Fig. 62-j

SUM AMP OUT (IC6, Pin 2)
−25 dBm

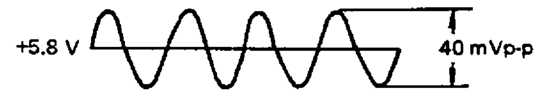


Fig. 62-k

DET. IN (both ends of R307)
−27 dBm (GAIN −2 dB)

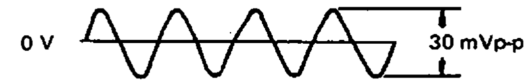


Fig. 62-l

DET. IN (both ends of R244)
−8 dBm (GAIN −2 dB)

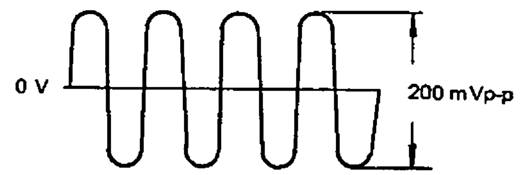
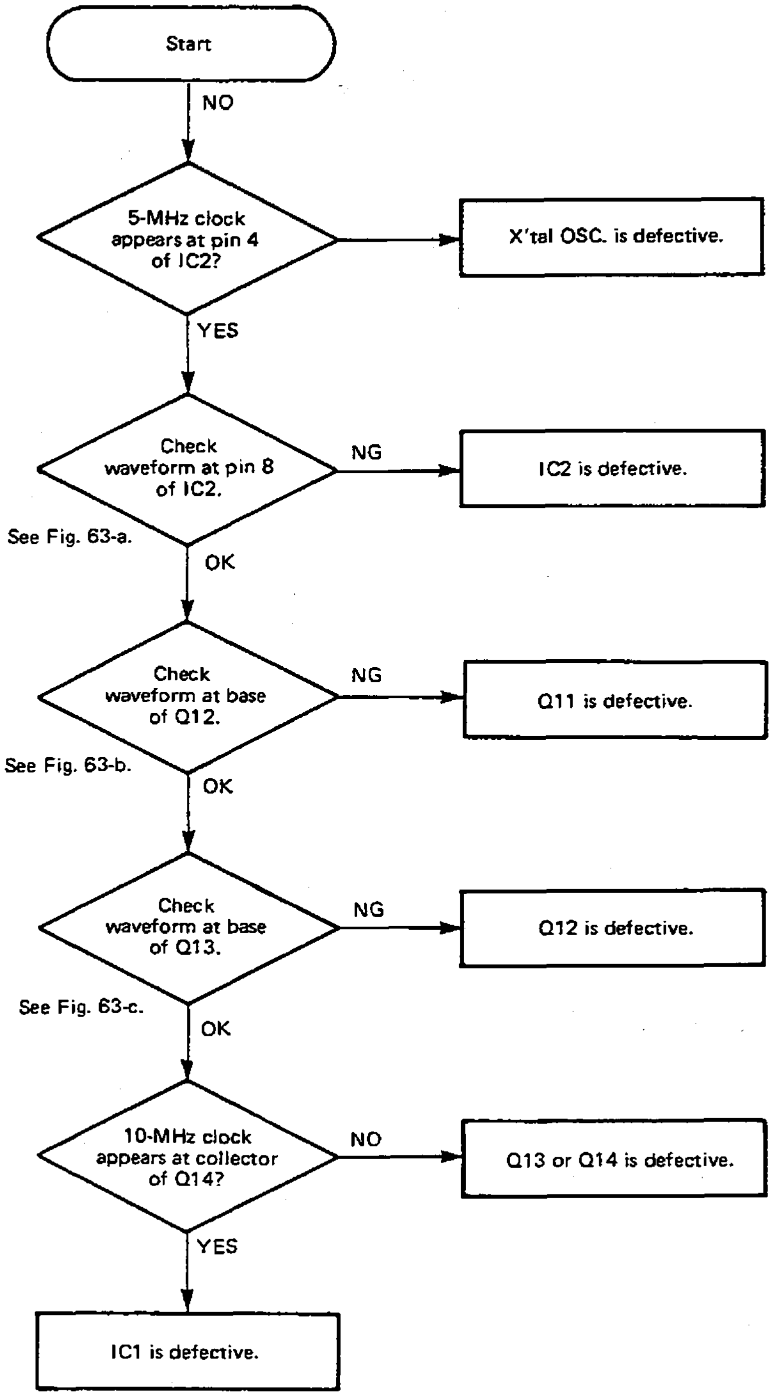


Fig. 62-m

CHART 63 Time Base



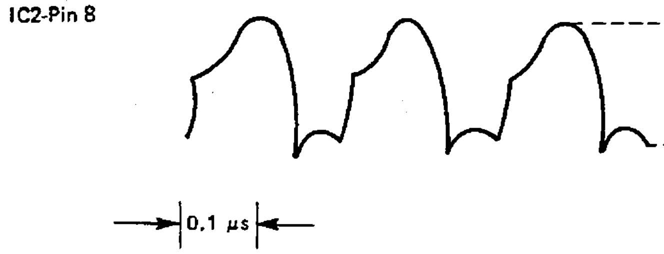


Fig. 63-a

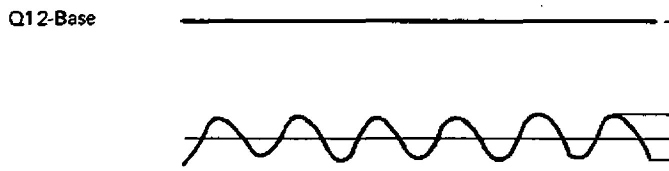


Fig. 63-b

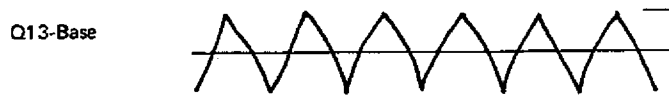
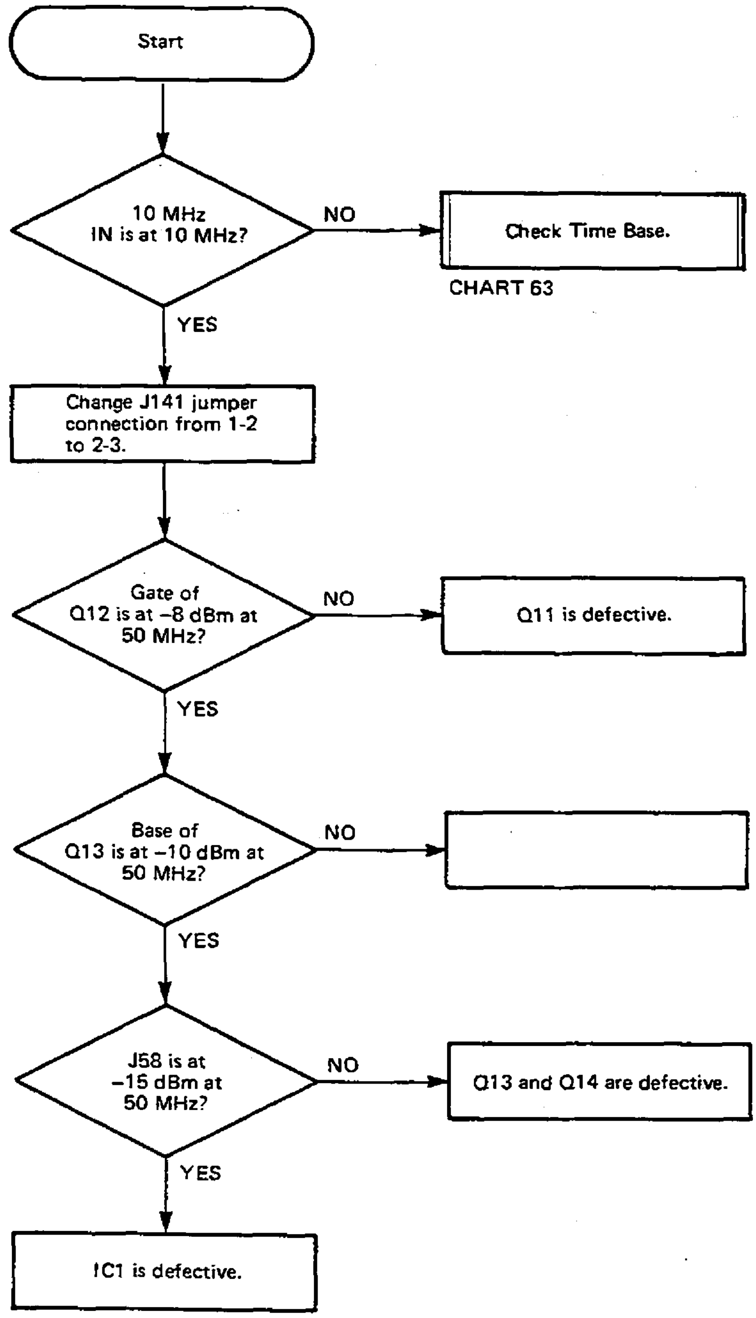


Fig. 63-c

CHART 64 50 MHz STD



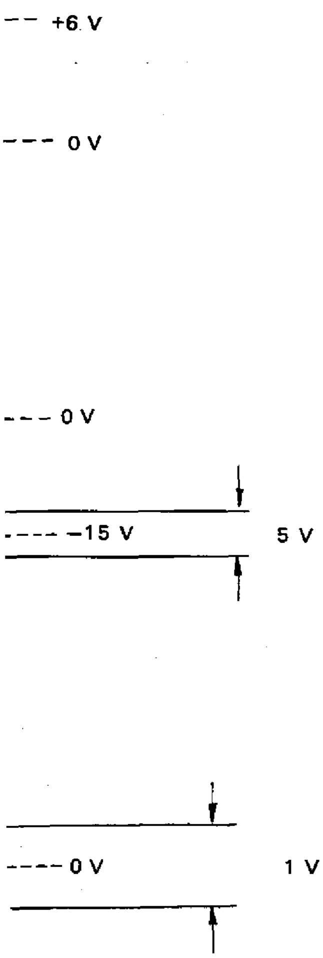


CHART 65 1st Mixer, Interface

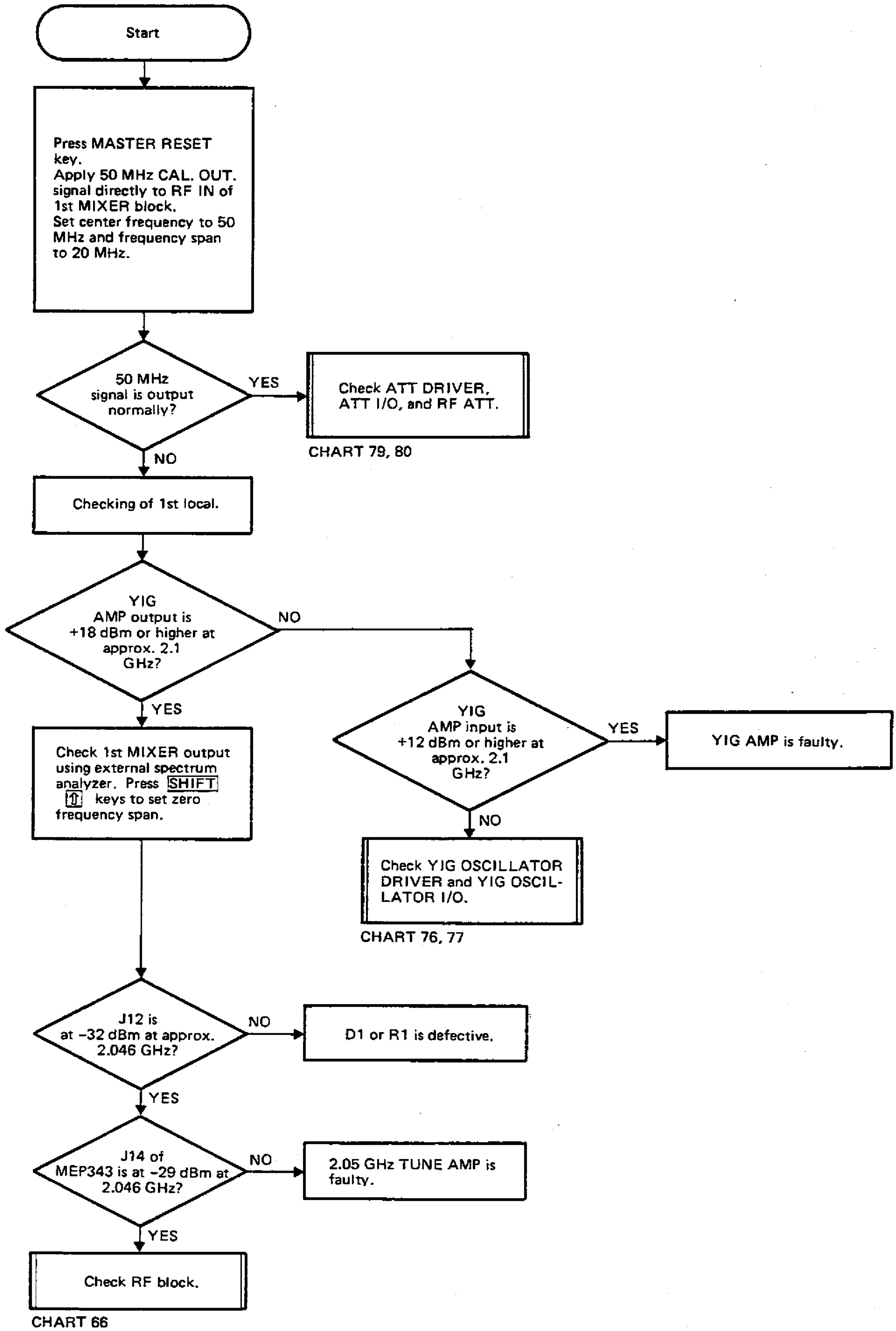
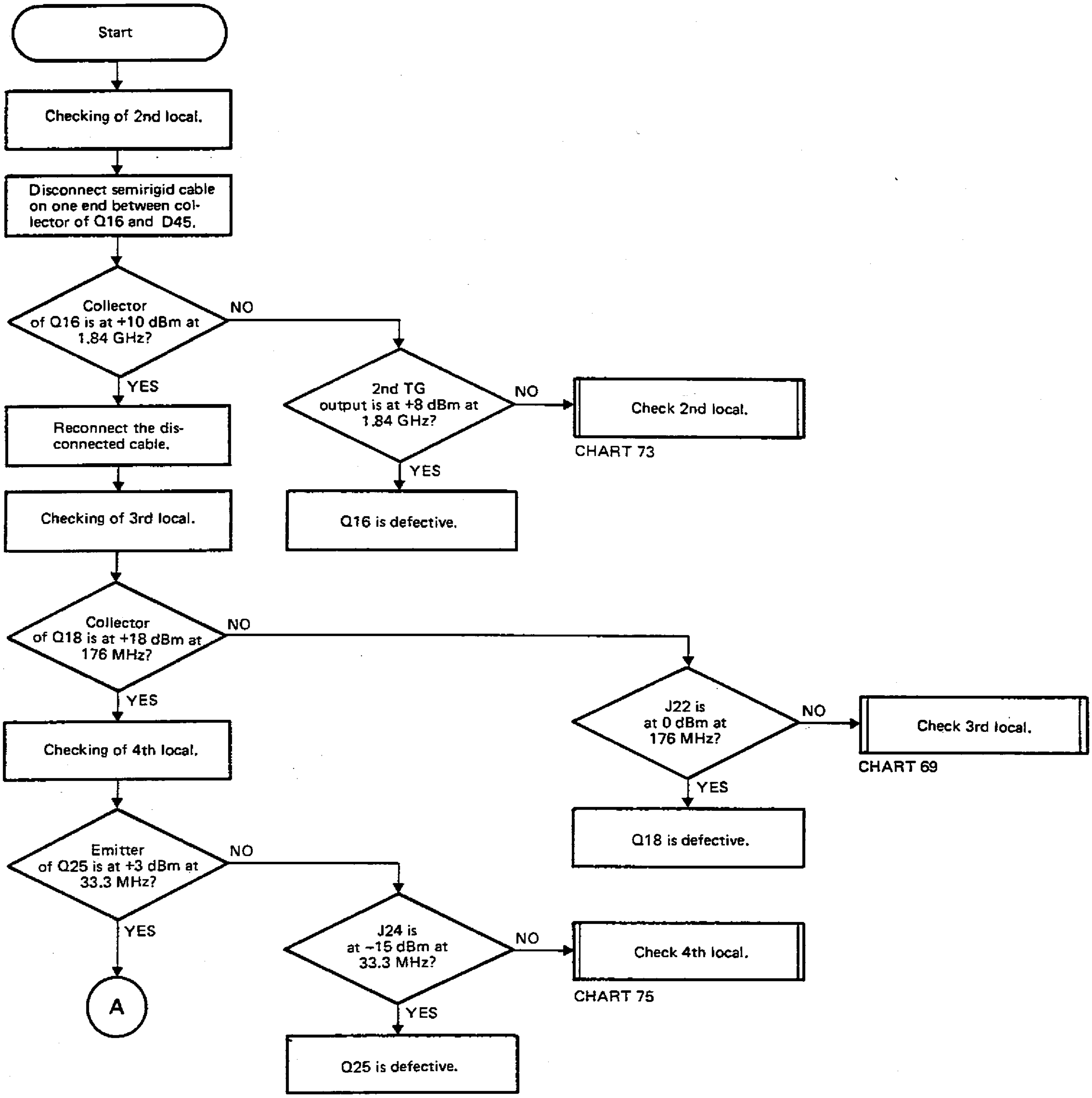
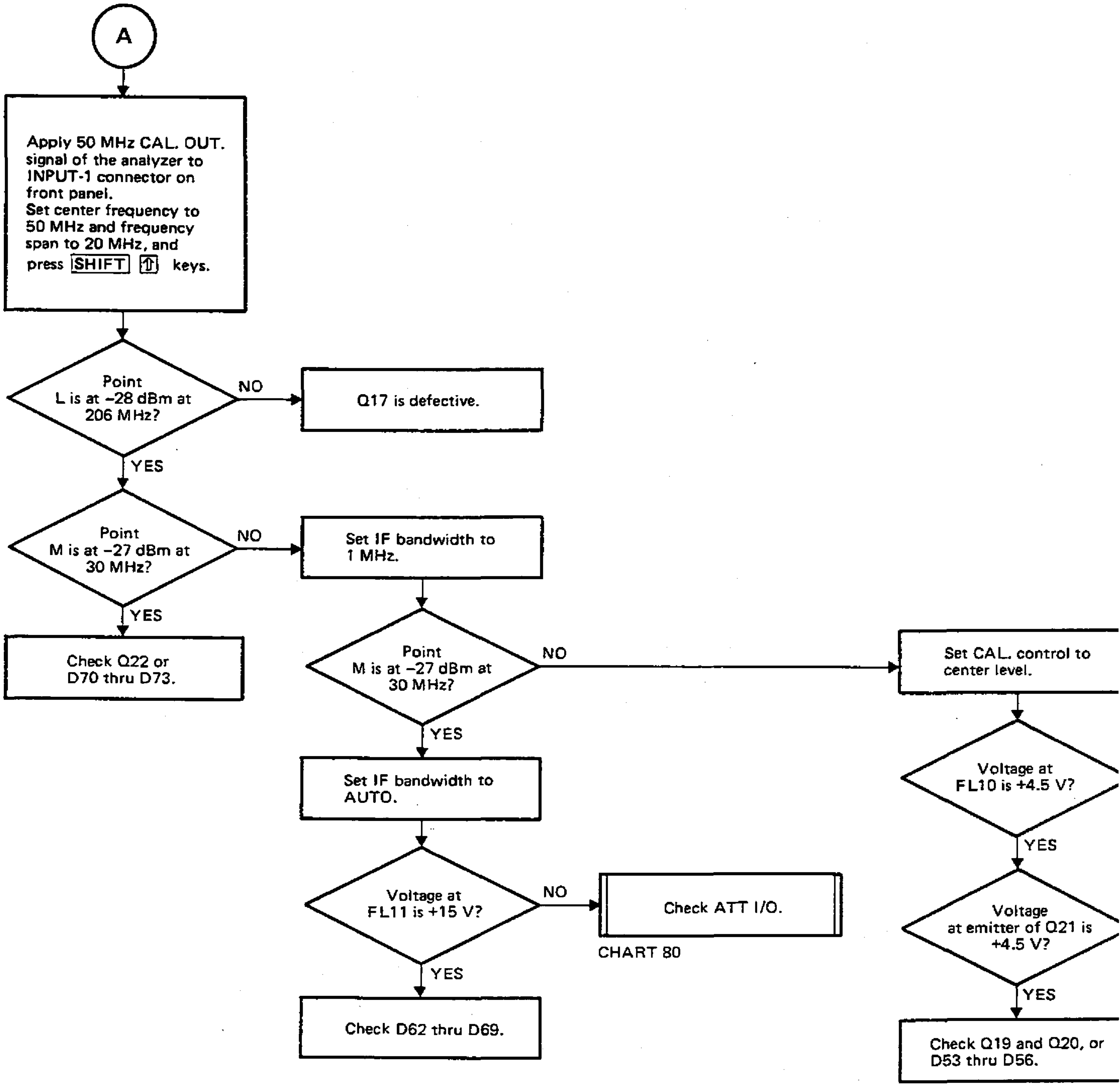


CHART 66 RF Block




A
Apply 50 MHz CAL. OUT. signal of the analyzer to INPUT-1 connector on front panel. Set center frequency to 50 MHz and frequency span to 20 MHz, and press SHIFT ⇧ keys.
Point L is at −28 dBm at 206 MHz?
NO
Q17 is defective.
YES
Point M is at −27 dBm at 30 MHz?
NO
Set IF bandwidth to 1 MHz.
YES
Check Q22 or D70 thru D73.
Point M is at −27 dBm at 30 MHz?
NO
Set CAL. control to center level.
YES
Set IF bandwidth to AUTO.
Voltage at FL10 is +4.5 V?
YES
Voltage at FL11 is +15 V?
NO
Check ATT I/O.
CHART 80
YES
Check D62 thru D69.
Voltage at emitter of Q21 is +4.5 V?
YES
Check Q19 and Q20, or D53 thru D56.

NO

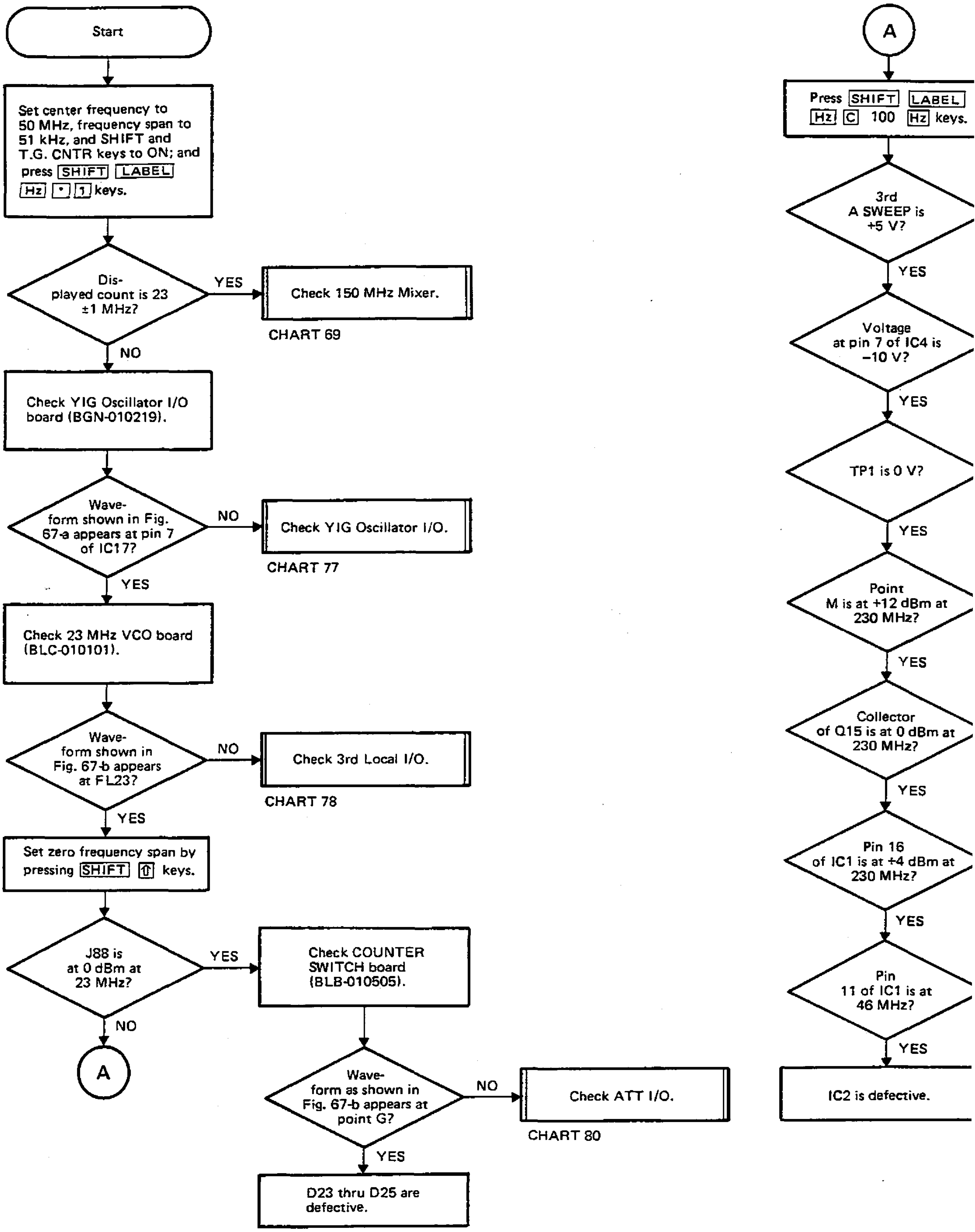
Check ATT I/O.

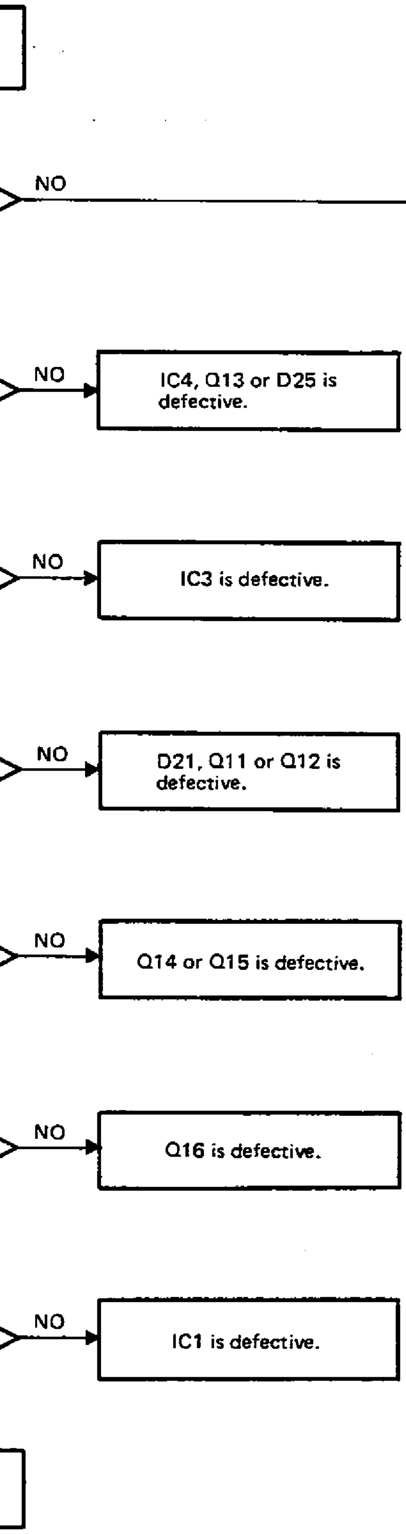
CHART 80

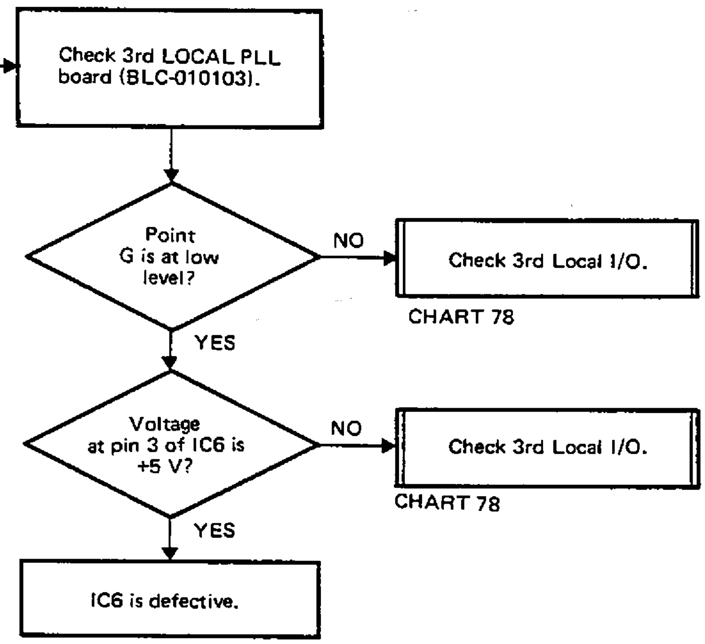
NO

IC1 or Q21 is defective.

CHART 67 23 MHz VCO







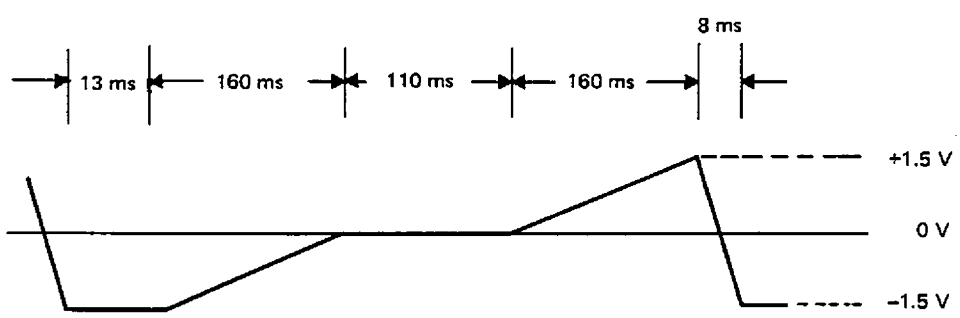


Fig. 67-a

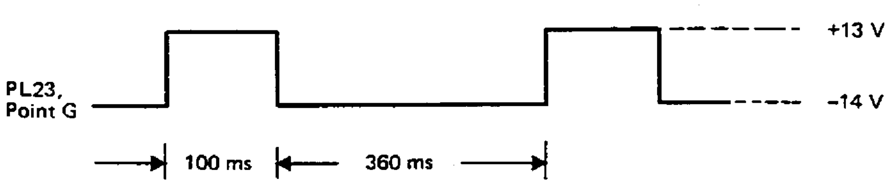


Fig. 67-b

CHART 68 2 MHz VCO (3rd)

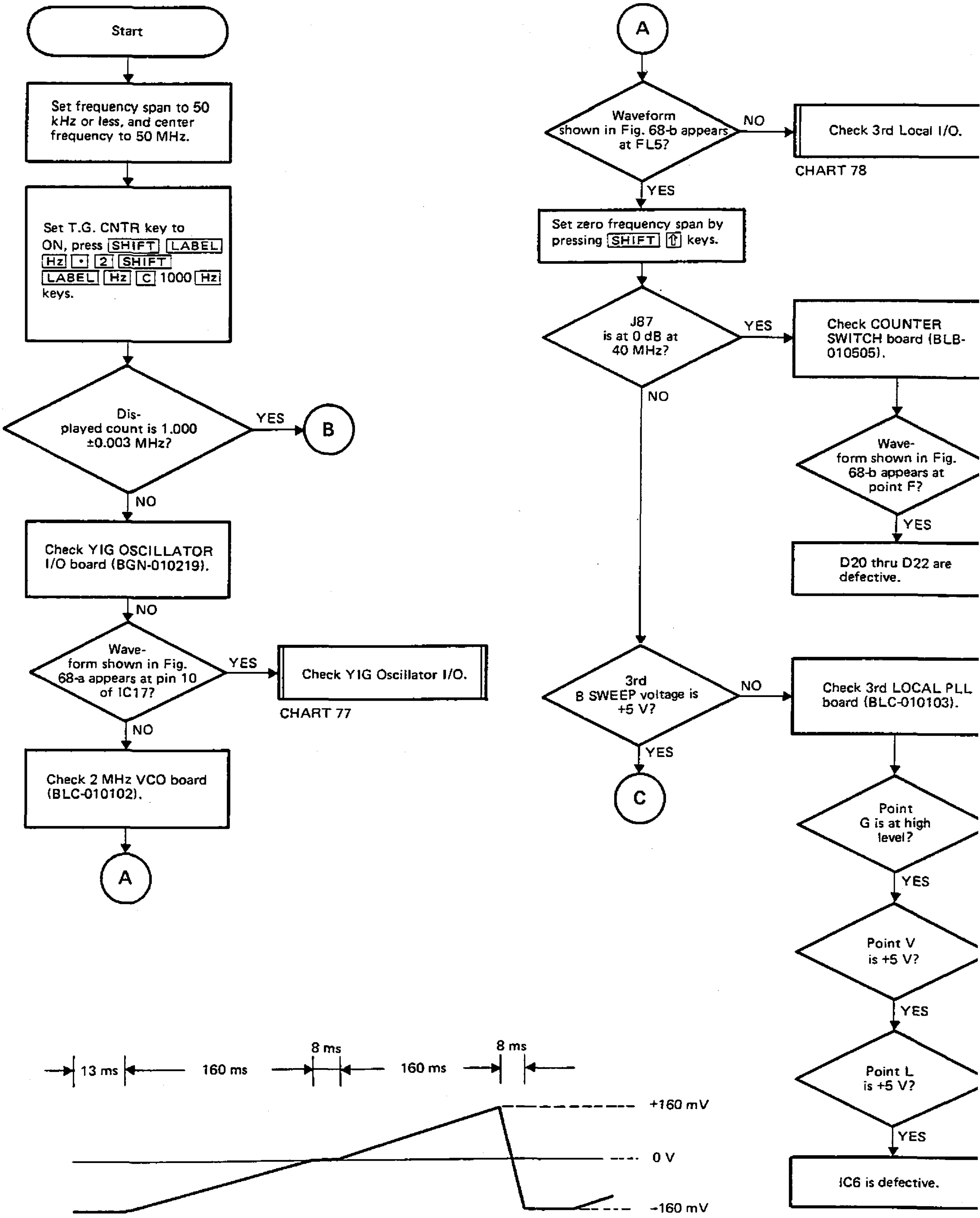
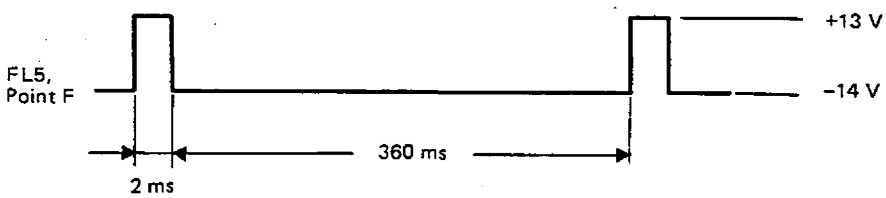
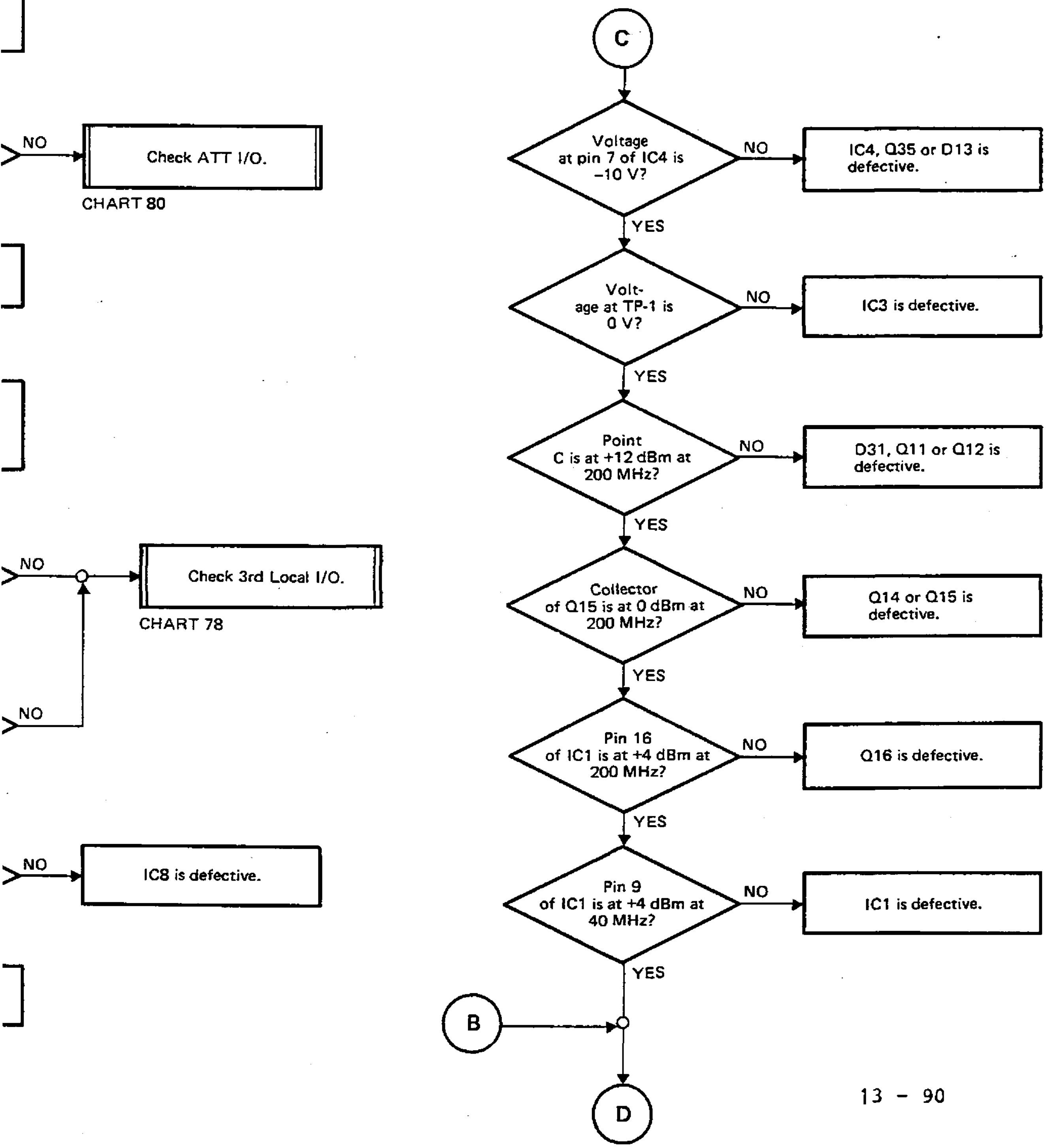


Fig. 68-a



FL5,
Point F
+13 V
−14 V
2 ms
360 ms

Fig. 68-b



C
Voltage at pin 7 of IC4 is −10 V?
NO
IC4, Q35 or D13 is defective.
YES
Volt-age at TP-1 is 0 V?
NO
IC3 is defective.
YES
Point C is at +12 dBm at 200 MHz?
NO
D31, Q11 or Q12 is defective.
YES
Collector of Q15 is at 0 dBm at 200 MHz?
NO
Q14 or Q15 is defective.
YES
Pin 16 of IC1 is at +4 dBm at 200 MHz?
NO
Q16 is defective.
YES
Pin 9 of IC1 is at +4 dBm at 40 MHz?
NO
IC1 is defective.
YES
B
D
NO
Check ATT I/O.
CHART 80
NO
Check 3rd Local I/O.
CHART 78
NO
NO
IC8 is defective.

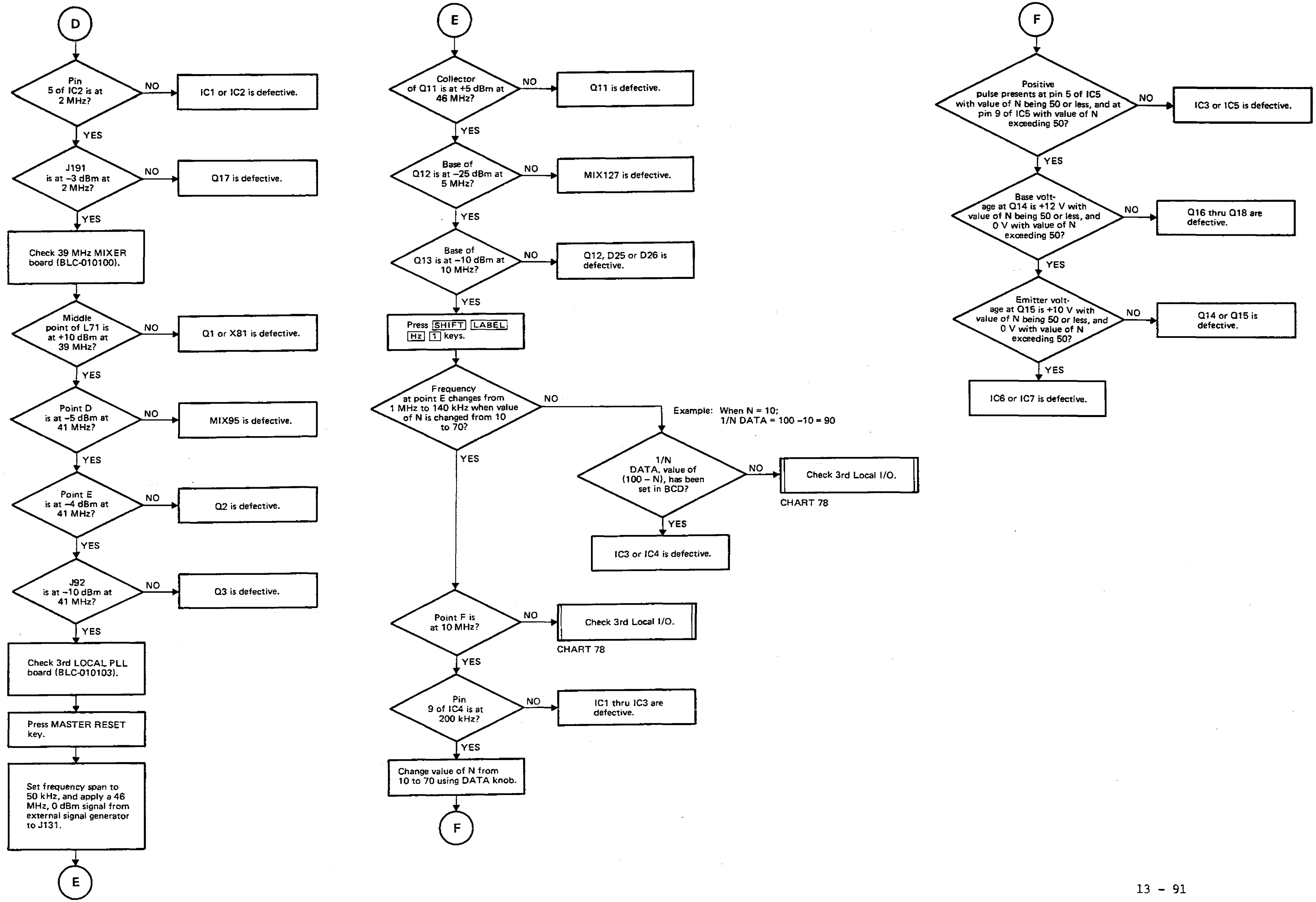

D
Pin 5 of IC2 is at 2 MHz?
NO
IC1 or IC2 is defective.
YES
J191 is at –3 dBm at 2 MHz?
NO
Q17 is defective.
YES
Check 39 MHz MIXER board (BLC-010100).
Middle point of L71 is at +10 dBm at 39 MHz?
NO
Q1 or X81 is defective.
YES
Point D is at –5 dBm at 41 MHz?
NO
MIX95 is defective.
YES
Point E is at –4 dBm at 41 MHz?
NO
Q2 is defective.
YES
J92 is at –10 dBm at 41 MHz?
NO
Q3 is defective.
YES
Check 3rd LOCAL PLL board (BLC-010103).
Press MASTER RESET key.
Set frequency span to 50 kHz, and apply a 46 MHz, 0 dBm signal from external signal generator to J131.
E
E
Collector of Q11 is at +5 dBm at 46 MHz?
NO
Q11 is defective.
YES
Base of Q12 is at –25 dBm at 5 MHz?
NO
MIX127 is defective.
YES
Base of Q13 is at –10 dBm at 10 MHz?
NO
Q12, D25 or D26 is defective.
YES
Press SHIFT LABEL Hz 1 keys.
Frequency at point E changes from 1 MHz to 140 kHz when value of N is changed from 10 to 70?
NO
Example: When N = 10; 1/N DATA = 100 –10 = 90
1/N DATA, value of (100 – N), has been set in BCD?
NO
Check 3rd Local I/O.
CHART 78
YES
IC3 or IC4 is defective.
YES
Point F is at 10 MHz?
NO
Check 3rd Local I/O.
CHART 78
YES
Pin 9 of IC4 is at 200 kHz?
NO
IC1 thru IC3 are defective.
YES
Change value of N from 10 to 70 using DATA knob.
F
F
Positive pulse presents at pin 5 of IC5 with value of N being 50 or less, and at pin 9 of IC5 with value of N exceeding 50?
NO
IC3 or IC5 is defective.
YES
Base voltage at Q14 is +12 V with value of N being 50 or less, and 0 V with value of N exceeding 50?
NO
Q16 thru Q18 are defective.
YES
Emitter voltage at Q15 is +10 V with value of N being 50 or less, and 0 V with value of N exceeding 50?
NO
Q14 or Q15 is defective.
YES
IC6 or IC7 is defective.

CHART 69 150 MHz Mixer

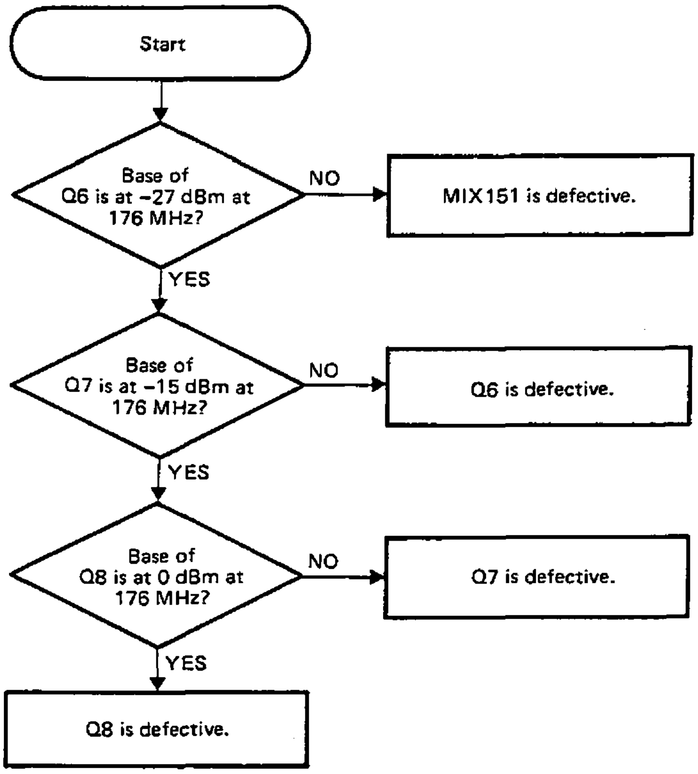


CHART 70 Checking Local Oscillator which does not Correctly Count

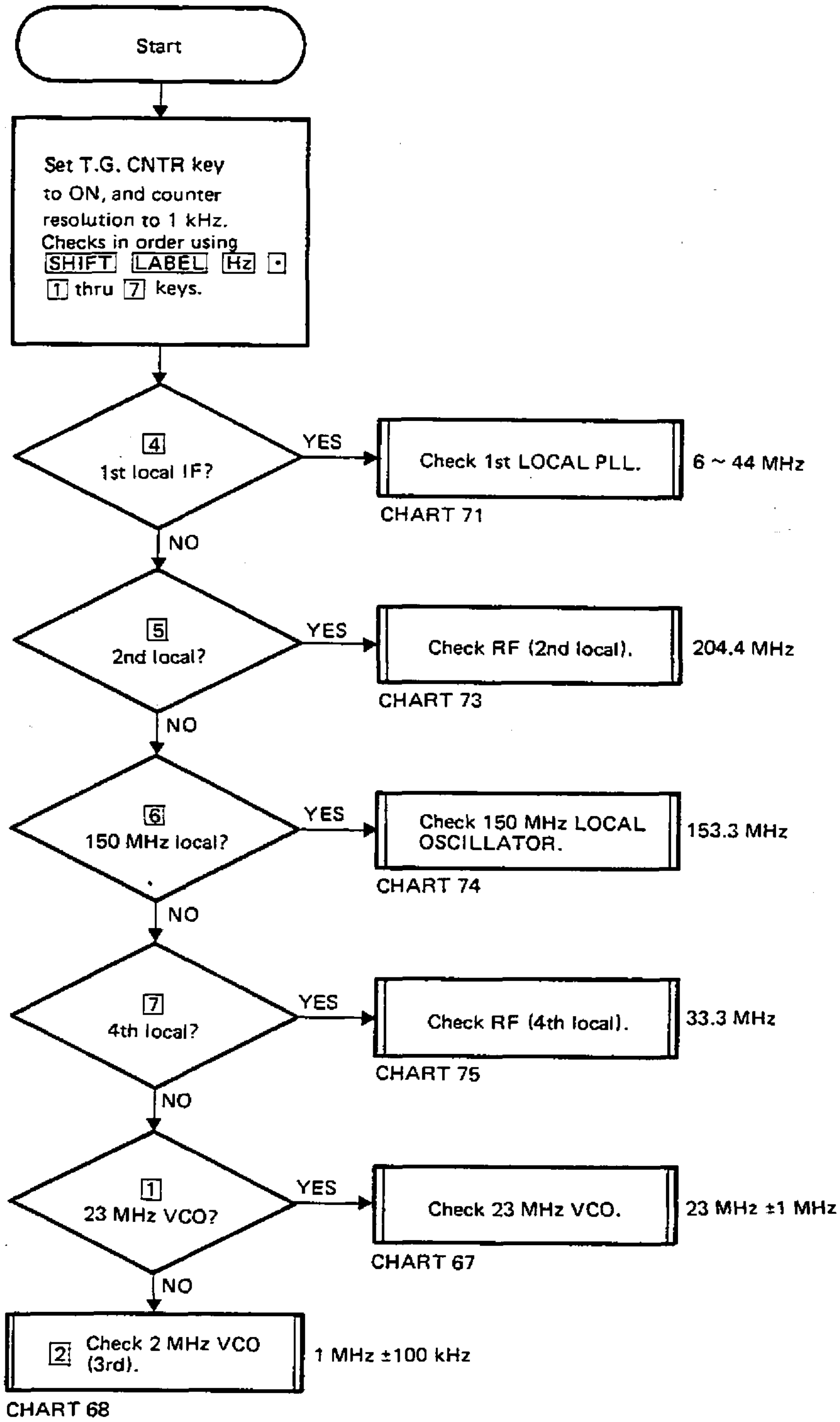
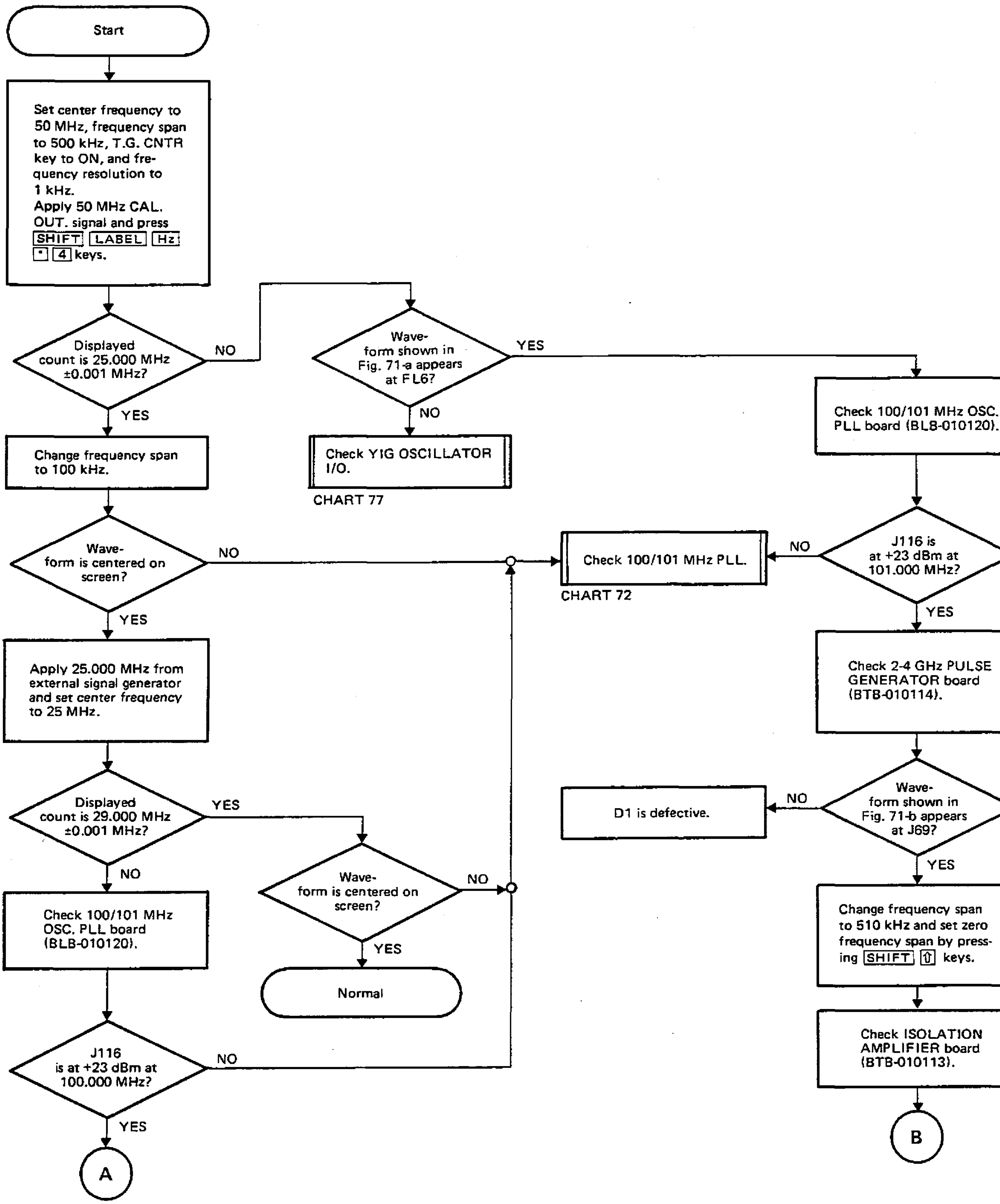
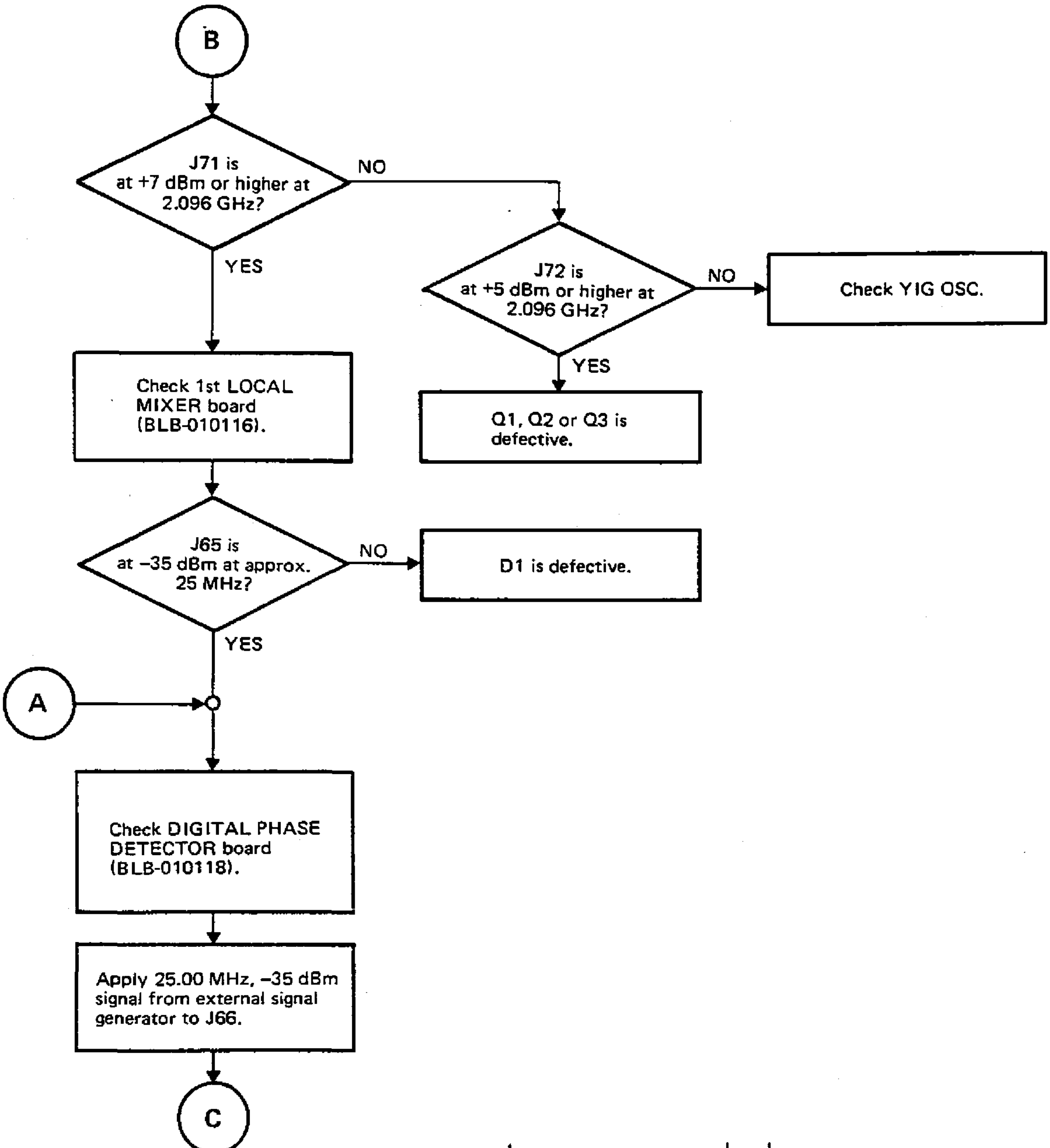


CHART 71 1st Local PLL





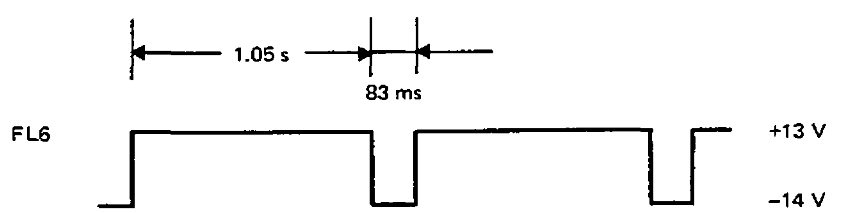


Fig. 71-a

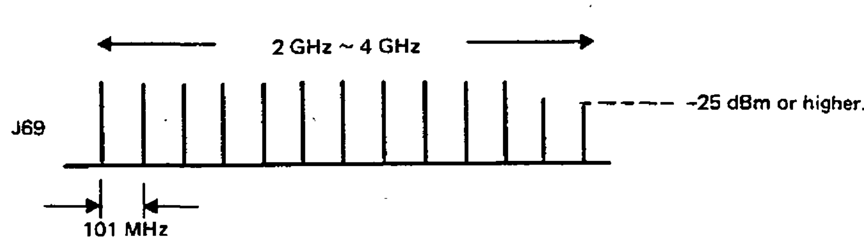
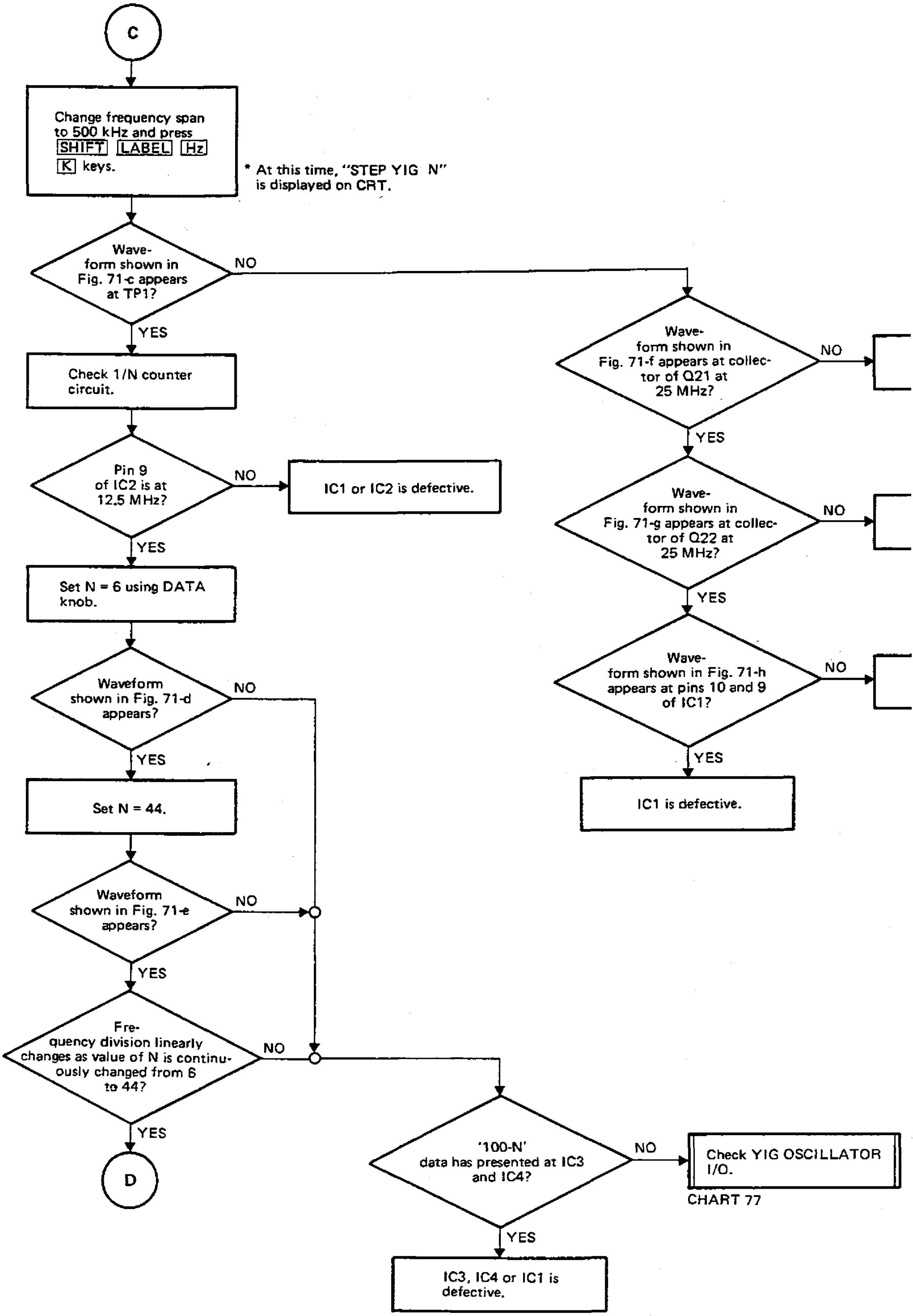


Fig. 71-b



C
Change frequency span to 500 kHz and press SHIFT LABEL Hz K keys.
* At this time, "STEP YIG N" is displayed on CRT.
Waveform shown in Fig. 71-c appears at TP1?
NO
YES
Check 1/N counter circuit.
Pin 9 of IC2 is at 12.5 MHz?
NO
IC1 or IC2 is defective.
YES
Set N = 6 using DATA knob.
Waveform shown in Fig. 71-d appears?
NO
YES
Set N = 44.
Waveform shown in Fig. 71-e appears?
NO
YES
Frequency division linearly changes as value of N is continuously changed from 6 to 44?
NO
YES
D
Waveform shown in Fig. 71-f appears at collector of Q21 at 25 MHz?
NO
YES
Waveform shown in Fig. 71-g appears at collector of Q22 at 25 MHz?
NO
YES
Waveform shown in Fig. 71-h appears at pins 10 and 9 of IC1?
NO
YES
IC1 is defective.
'100-N' data has presented at IC3 and IC4?
NO
Check YIG OSCILLATOR I/O.
CHART 77
YES
IC3, IC4 or IC1 is defective.

TP-1

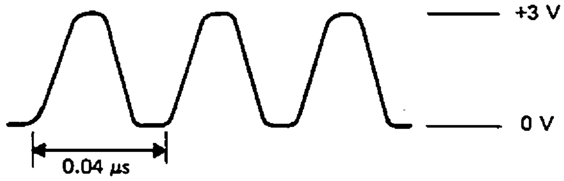


Fig. 71-c

Q21 is defective.

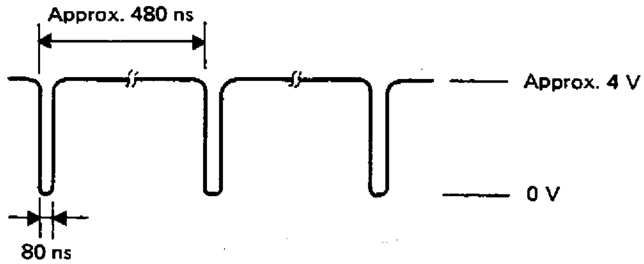
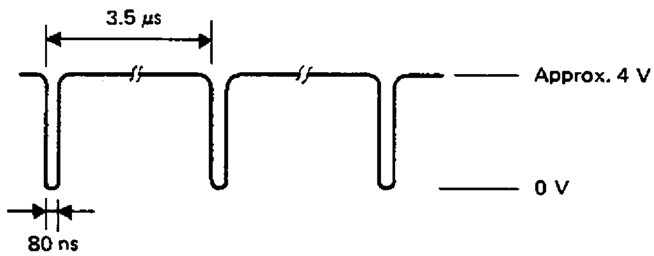


Fig. 71-d

Q22 and Q23 are defective.



Q24 and Q25 are defective.

Fig. 71-e

Q21 (Collector)

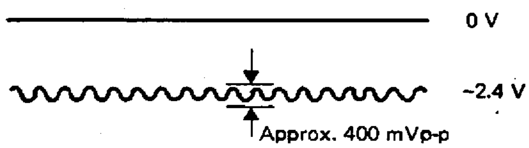


Fig. 71-f

Q22 (Collector)

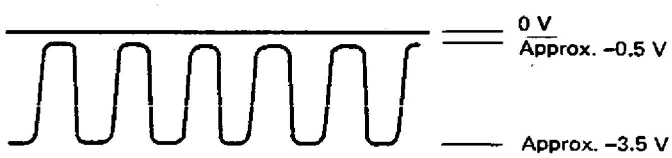


Fig. 71-g

IC1-Pins 9 and 10

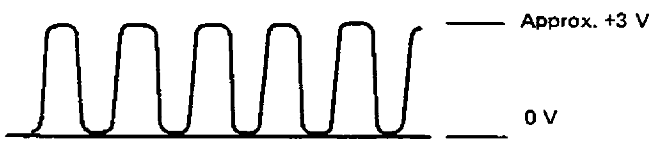
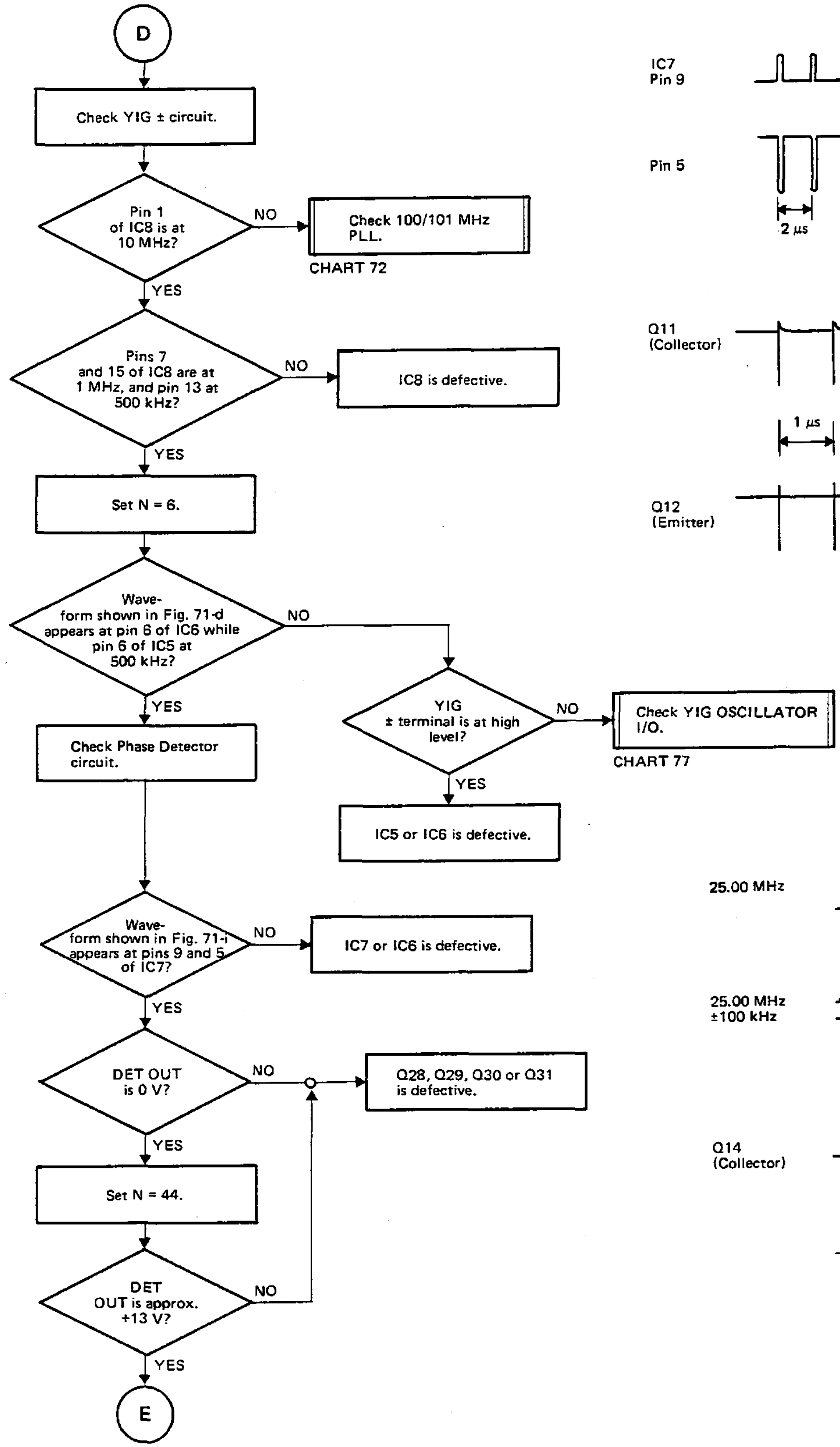


Fig. 71-h



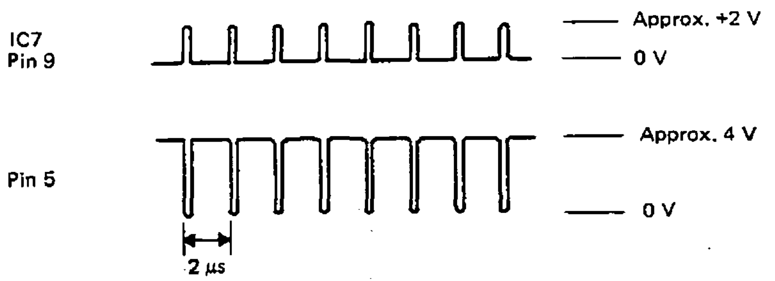


Fig. 71-i

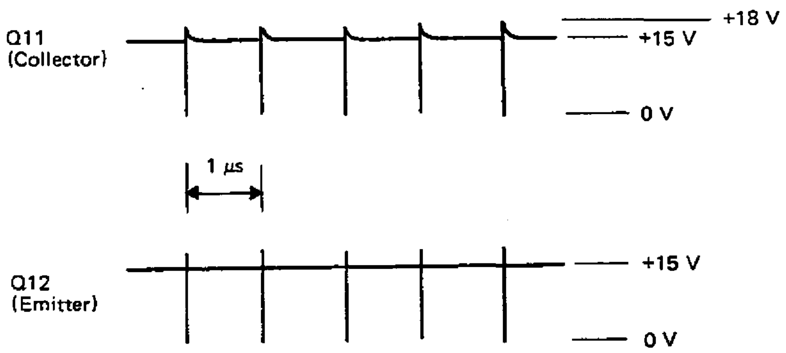


Fig. 71-j

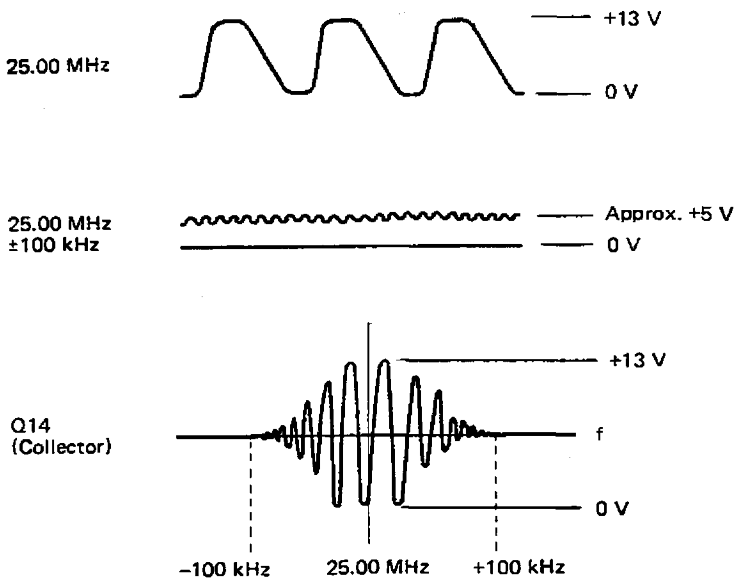


Fig. 71-k

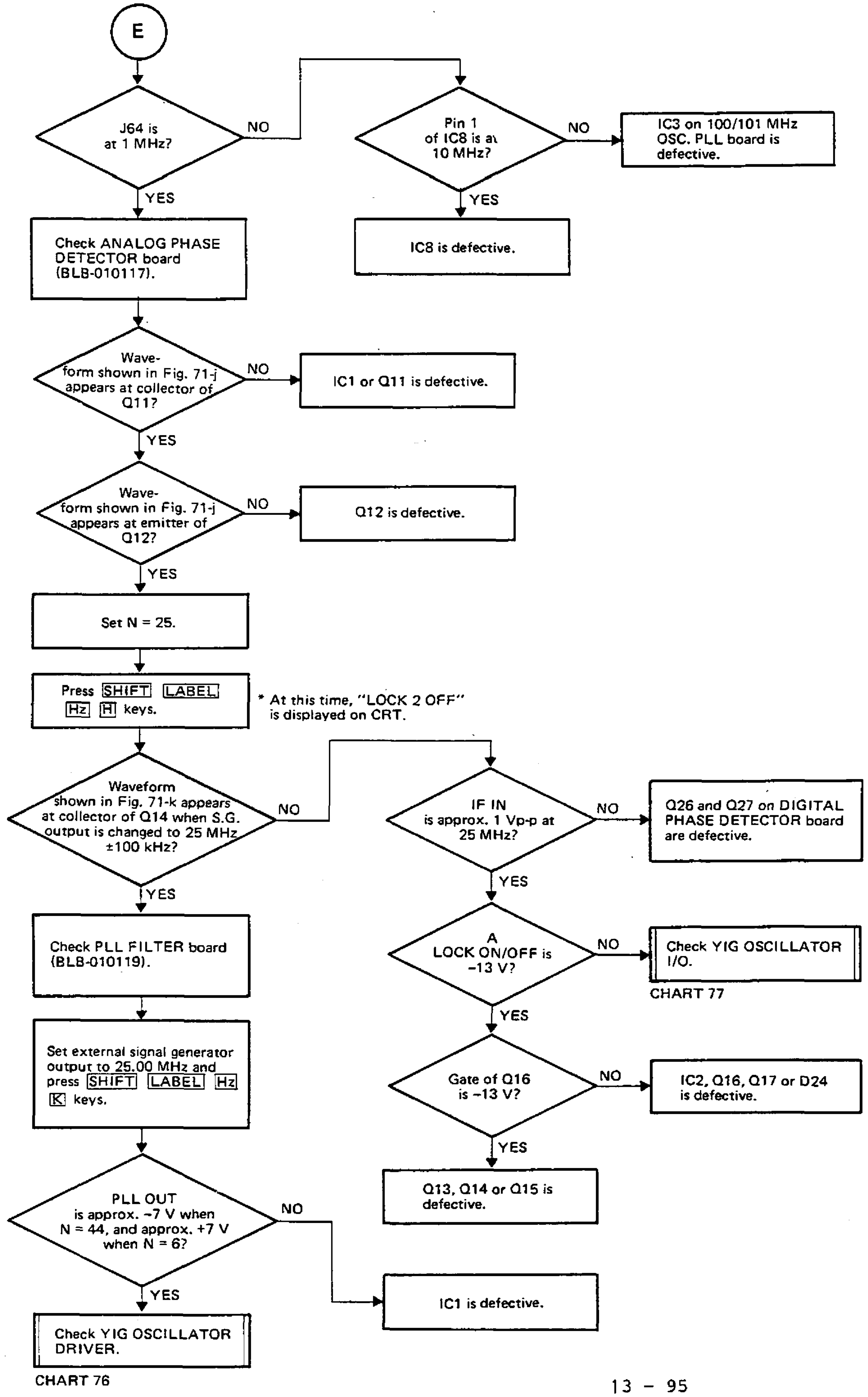
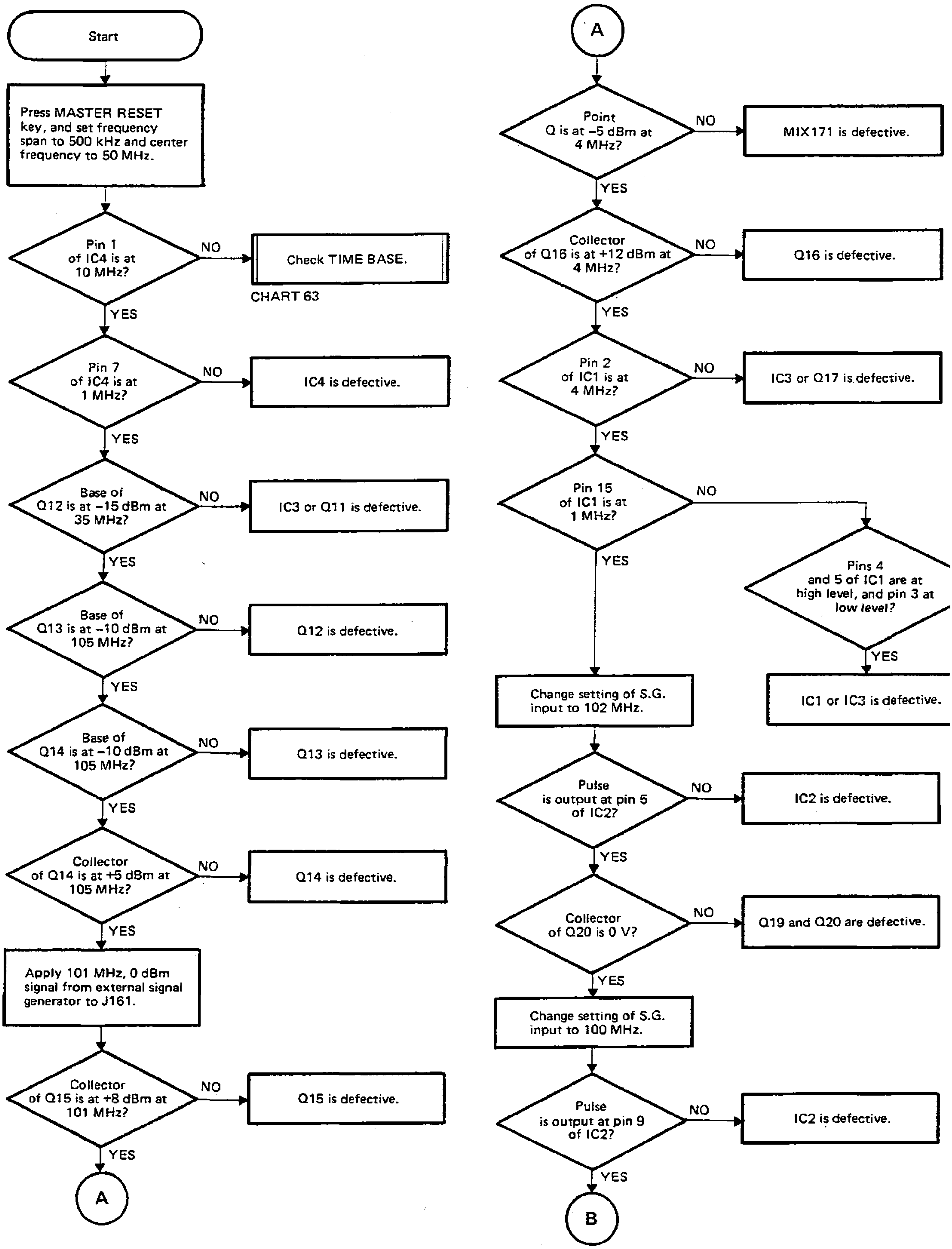


CHART 72 100/101 MHz PLL



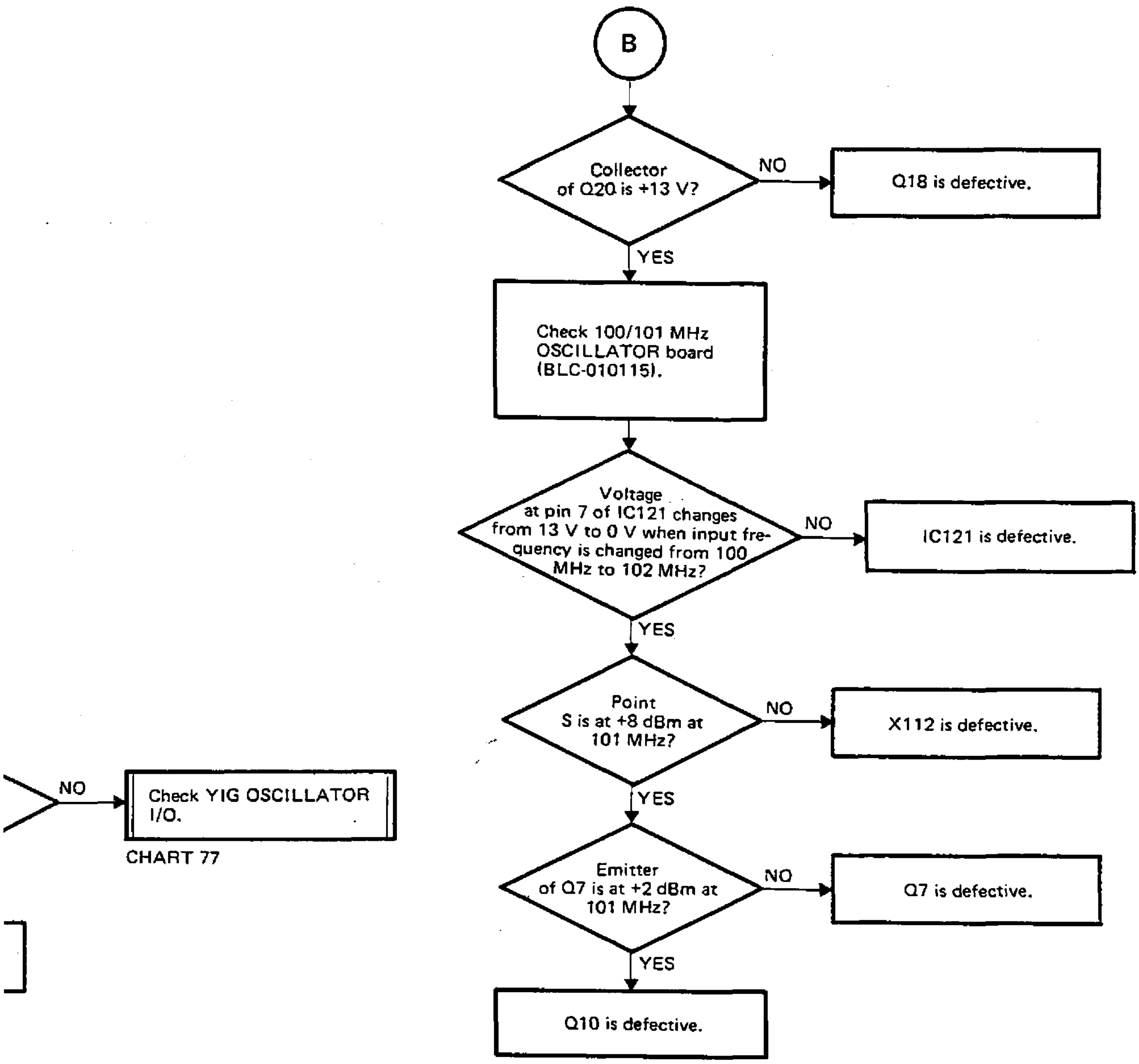
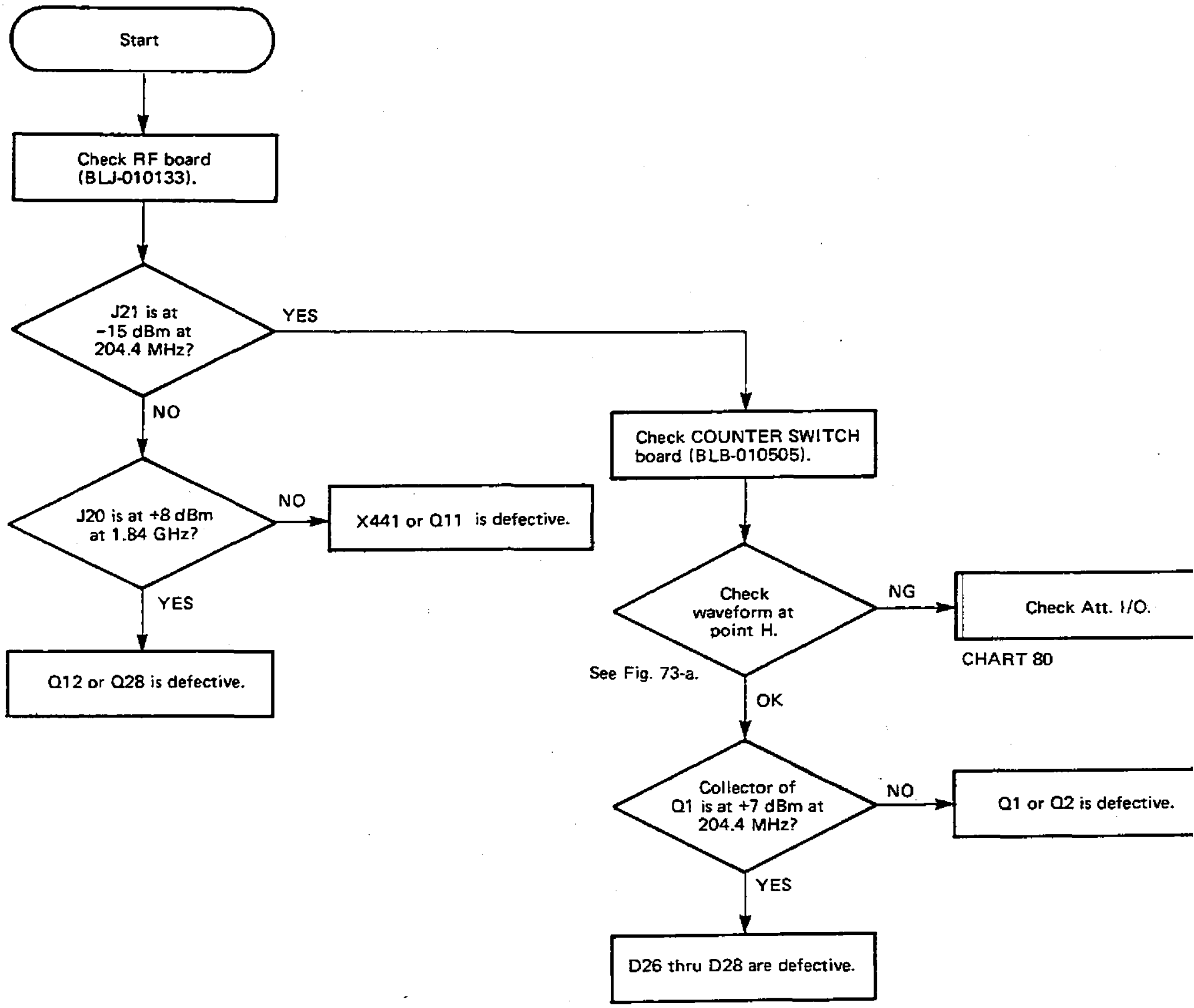

B
Collector of Q20 is +13 V?
NO
Q18 is defective.
YES
Check 100/101 MHz OSCILLATOR board (BLC-010115).
Voltage at pin 7 of IC121 changes from 13 V to 0 V when input frequency is changed from 100 MHz to 102 MHz?
NO
IC121 is defective.
YES
Point S is at +8 dBm at 101 MHz?
NO
X112 is defective.
YES
Emitter of Q7 is at +2 dBm at 101 MHz?
NO
Q7 is defective.
YES
Q10 is defective.
NO
Check YIG OSCILLATOR I/O.
CHART 77

CHART 73 RF (2nd Local)



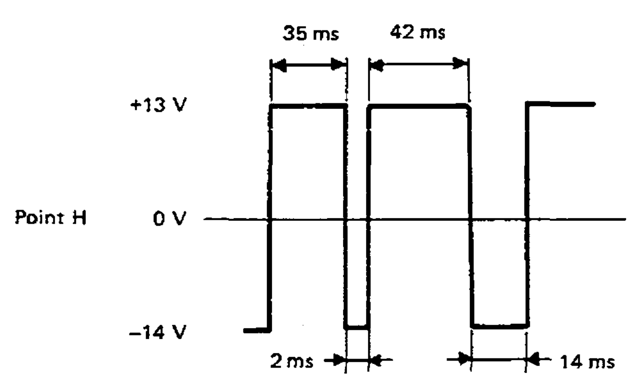
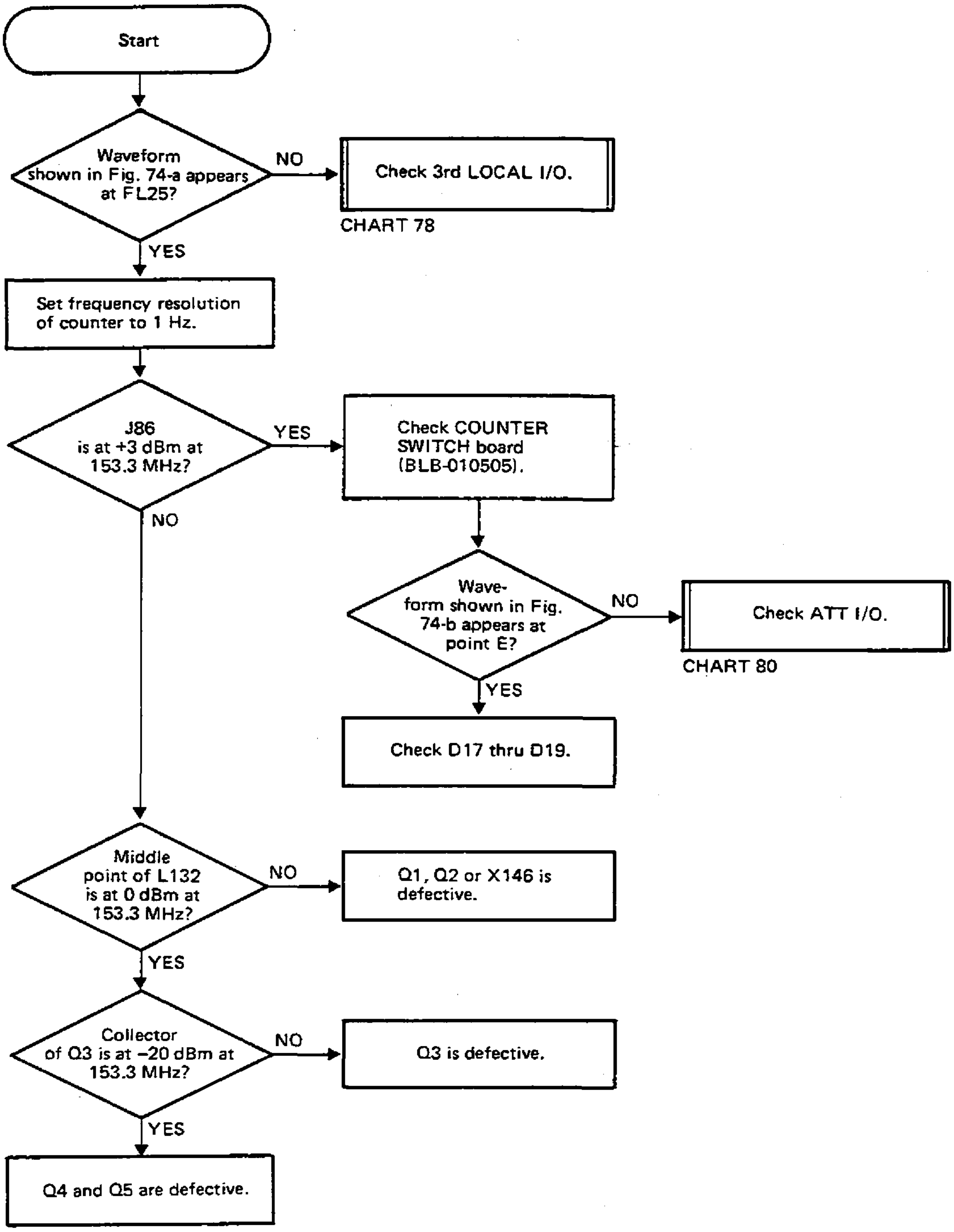


Fig. 73-a

CHART 74 150 MHz Local Oscillator



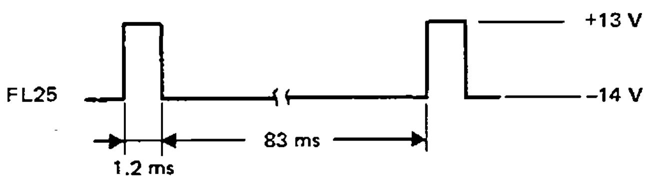


Fig. 74-a

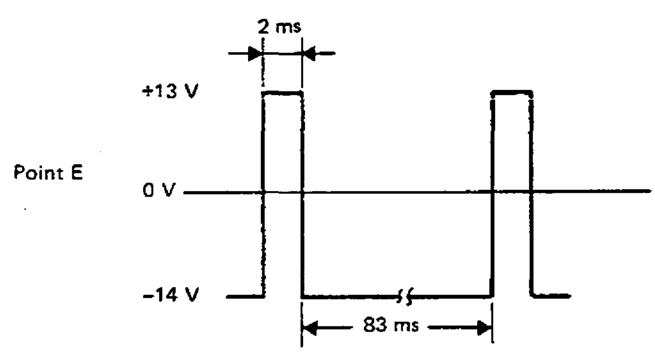
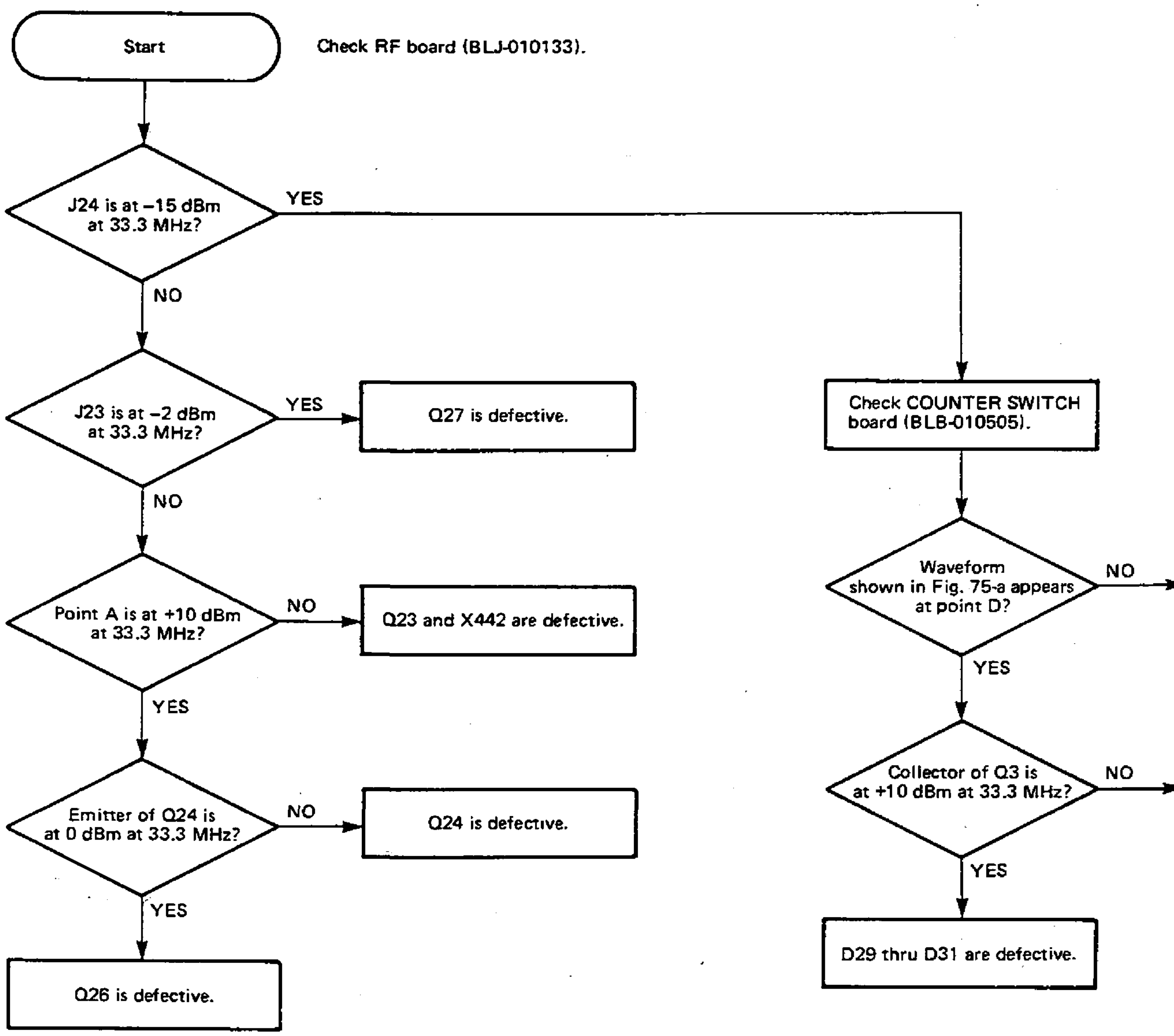


Fig. 74-b

CHART 75 RF (4th Local)



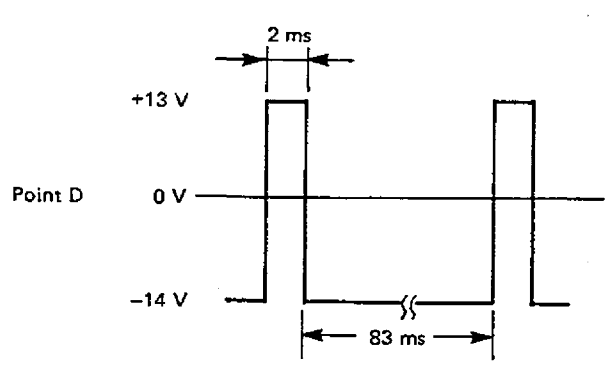
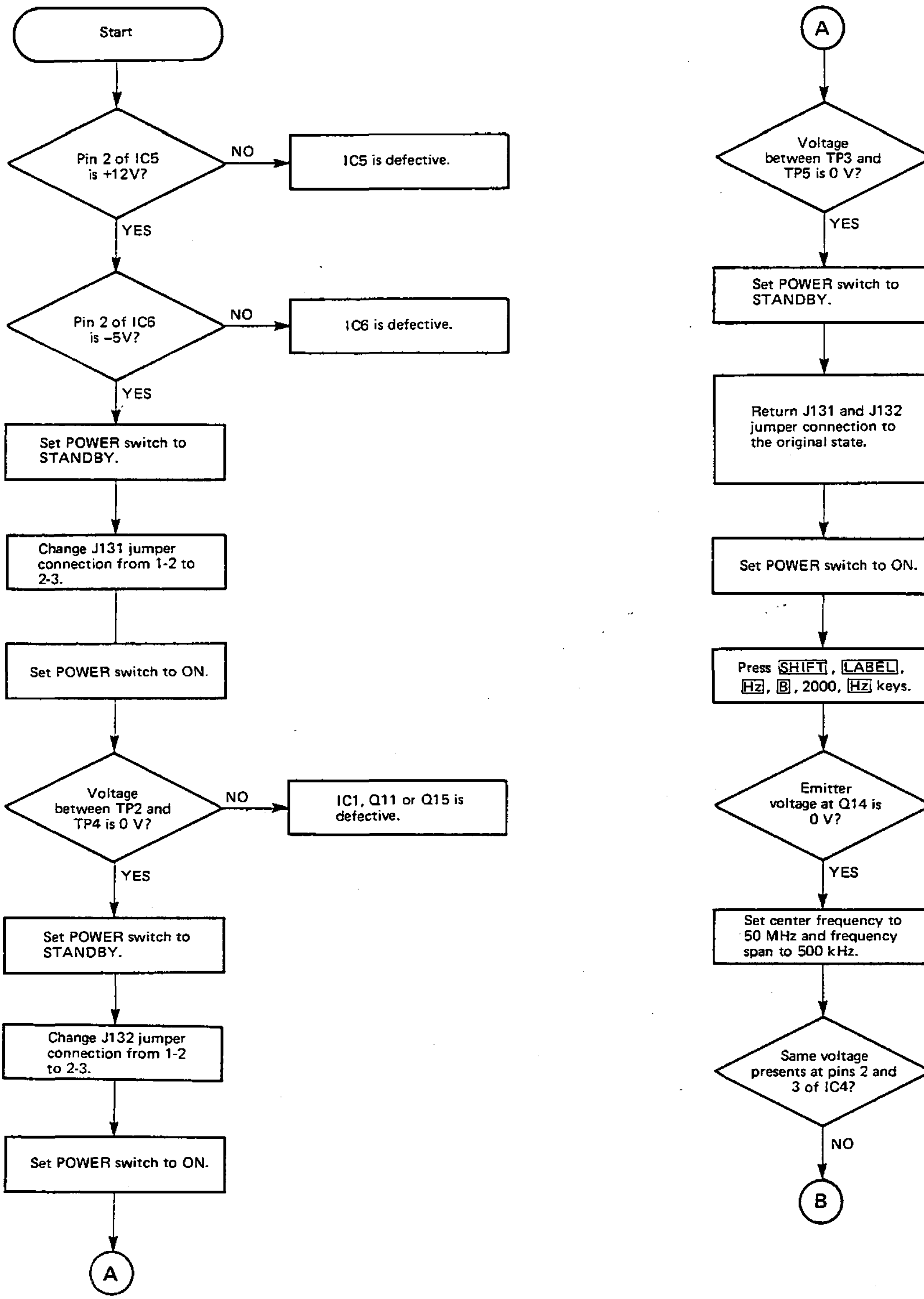


Fig. 75-a

Check ATT I/O.

CHART 80

Q3 or Q4 is defective.


Start
Pin 2 of IC5 is +12V?
NO
IC5 is defective.
YES
Pin 2 of IC6 is –5V?
NO
IC6 is defective.
YES
Set POWER switch to STANDBY.
Change J131 jumper connection from 1-2 to 2-3.
Set POWER switch to ON.
Voltage between TP2 and TP4 is 0 V?
NO
IC1, Q11 or Q15 is defective.
YES
Set POWER switch to STANDBY.
Change J132 jumper connection from 1-2 to 2-3.
Set POWER switch to ON.
A
A
Voltage between TP3 and TP5 is 0 V?
YES
Set POWER switch to STANDBY.
Return J131 and J132 jumper connection to the original state.
Set POWER switch to ON.
Press SHIFT, LABEL, Hz, B, 2000, Hz keys.
Emitter voltage at Q14 is 0 V?
YES
Set center frequency to 50 MHz and frequency span to 500 kHz.
Same voltage presents at pins 2 and 3 of IC4?
NO
B

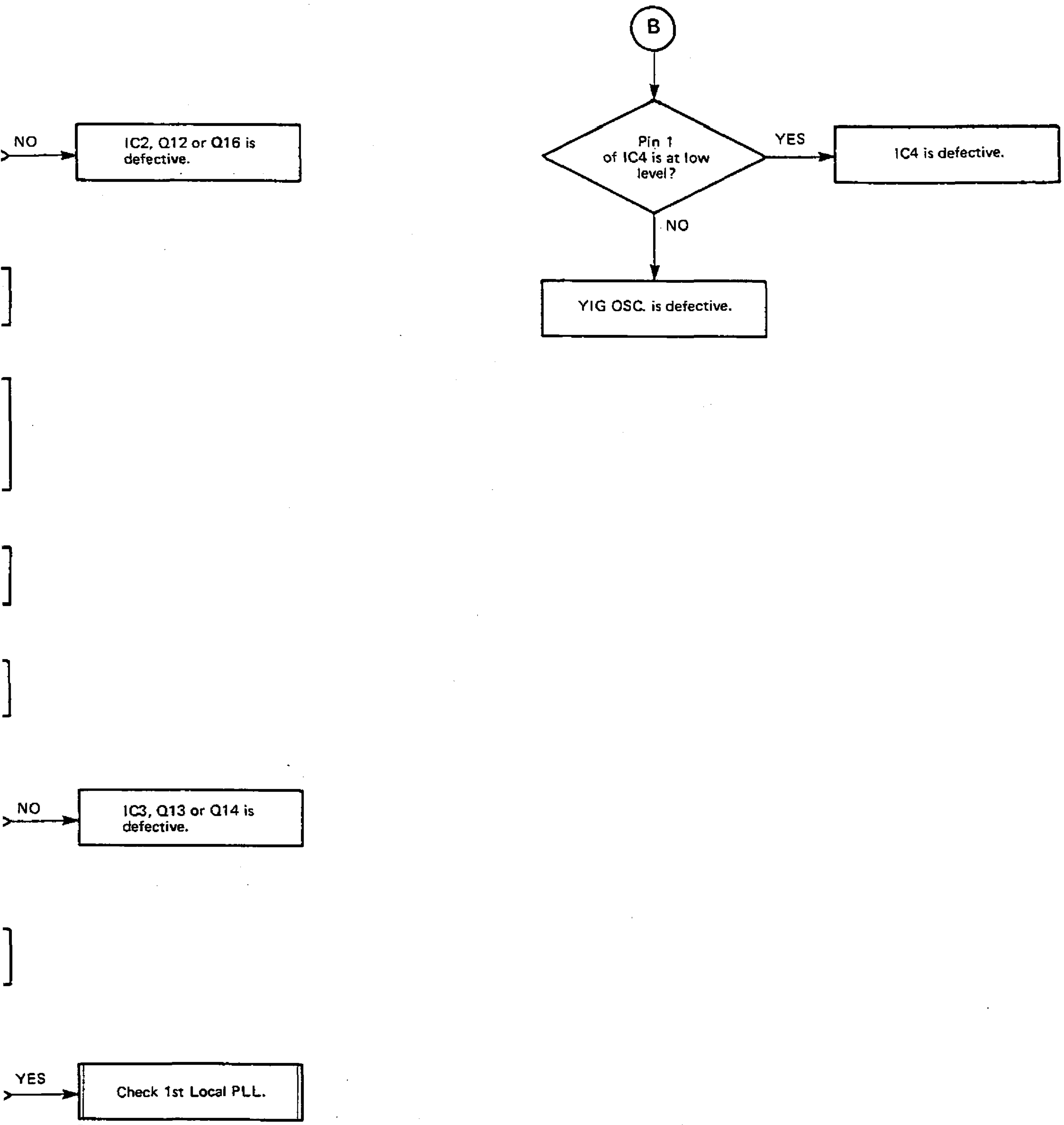
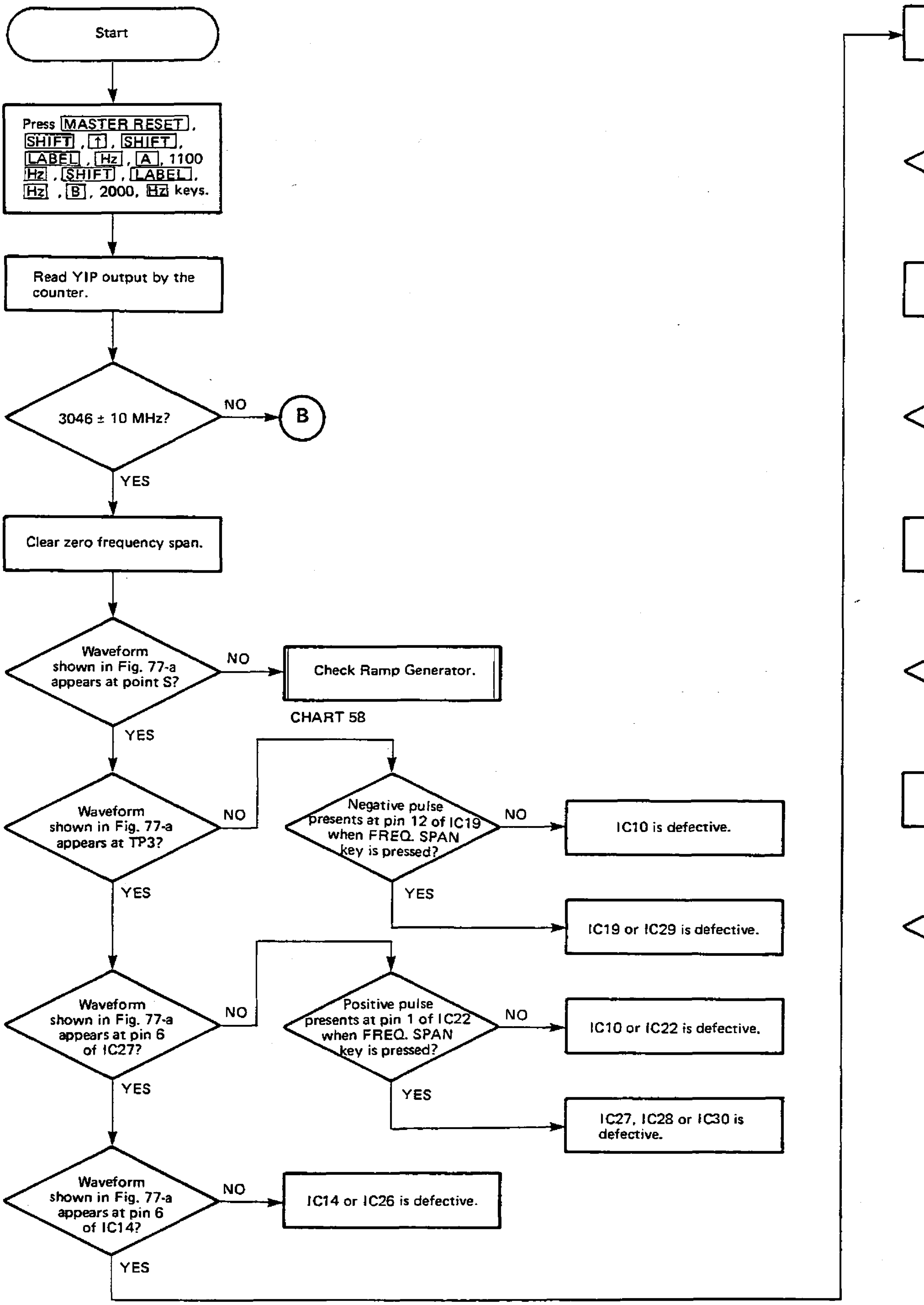
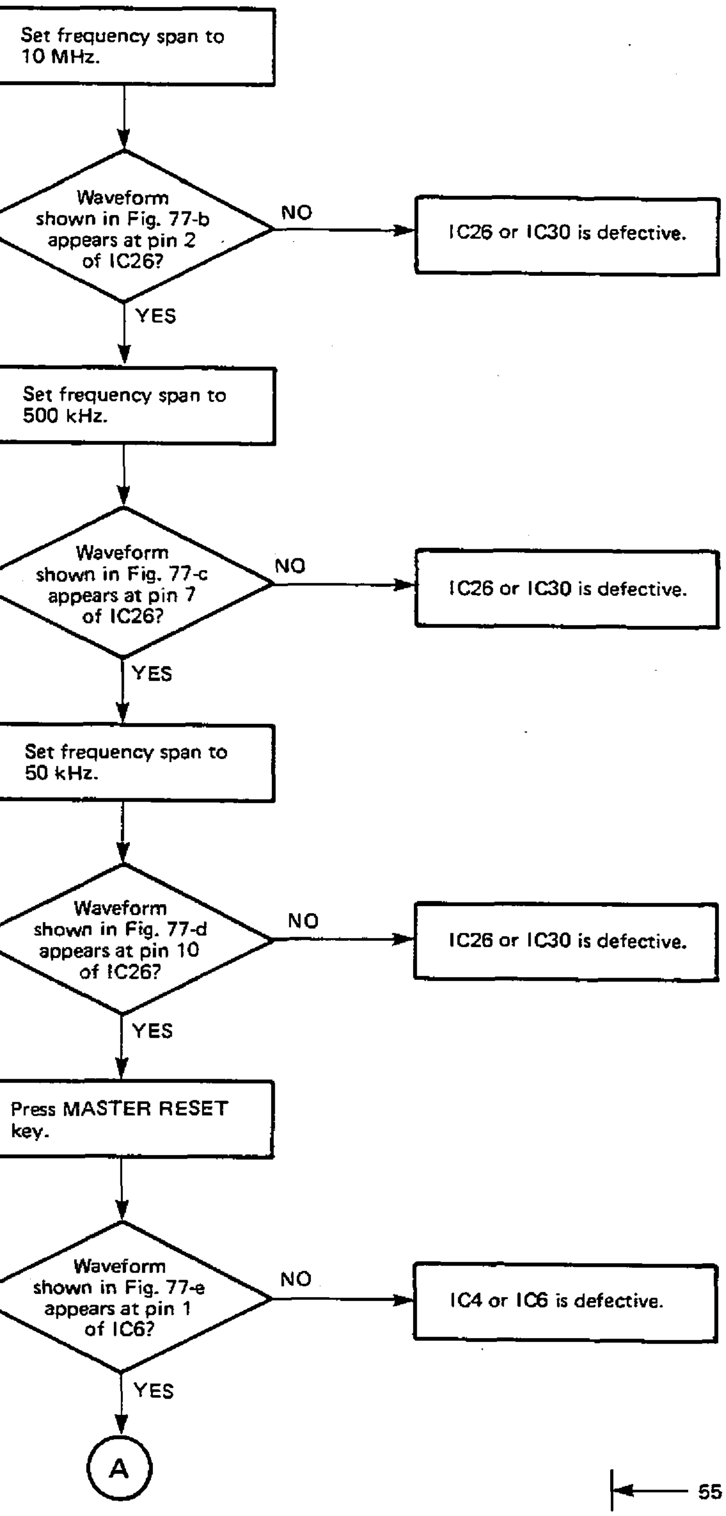

B
Pin 1 of IC4 is at low level?
YES
IC4 is defective.
NO
YIG OSC. is defective.
NO
IC2, Q12 or Q16 is defective.
NO
IC3, Q13 or Q14 is defective.
YES
Check 1st Local PLL.

CHART 71.

CHART 77 YIG Oscillator I/O




Set frequency span to 10 MHz.
Waveform shown in Fig. 77-b appears at pin 2 of IC26?
NO
IC26 or IC30 is defective.
YES
Set frequency span to 500 kHz.
Waveform shown in Fig. 77-c appears at pin 7 of IC26?
NO
IC26 or IC30 is defective.
YES
Set frequency span to 50 kHz.
Waveform shown in Fig. 77-d appears at pin 10 of IC26?
NO
IC26 or IC30 is defective.
YES
Press MASTER RESET key.
Waveform shown in Fig. 77-e appears at pin 1 of IC6?
NO
IC4 or IC6 is defective.
YES
A

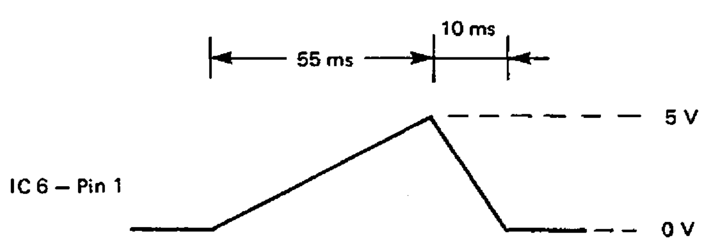
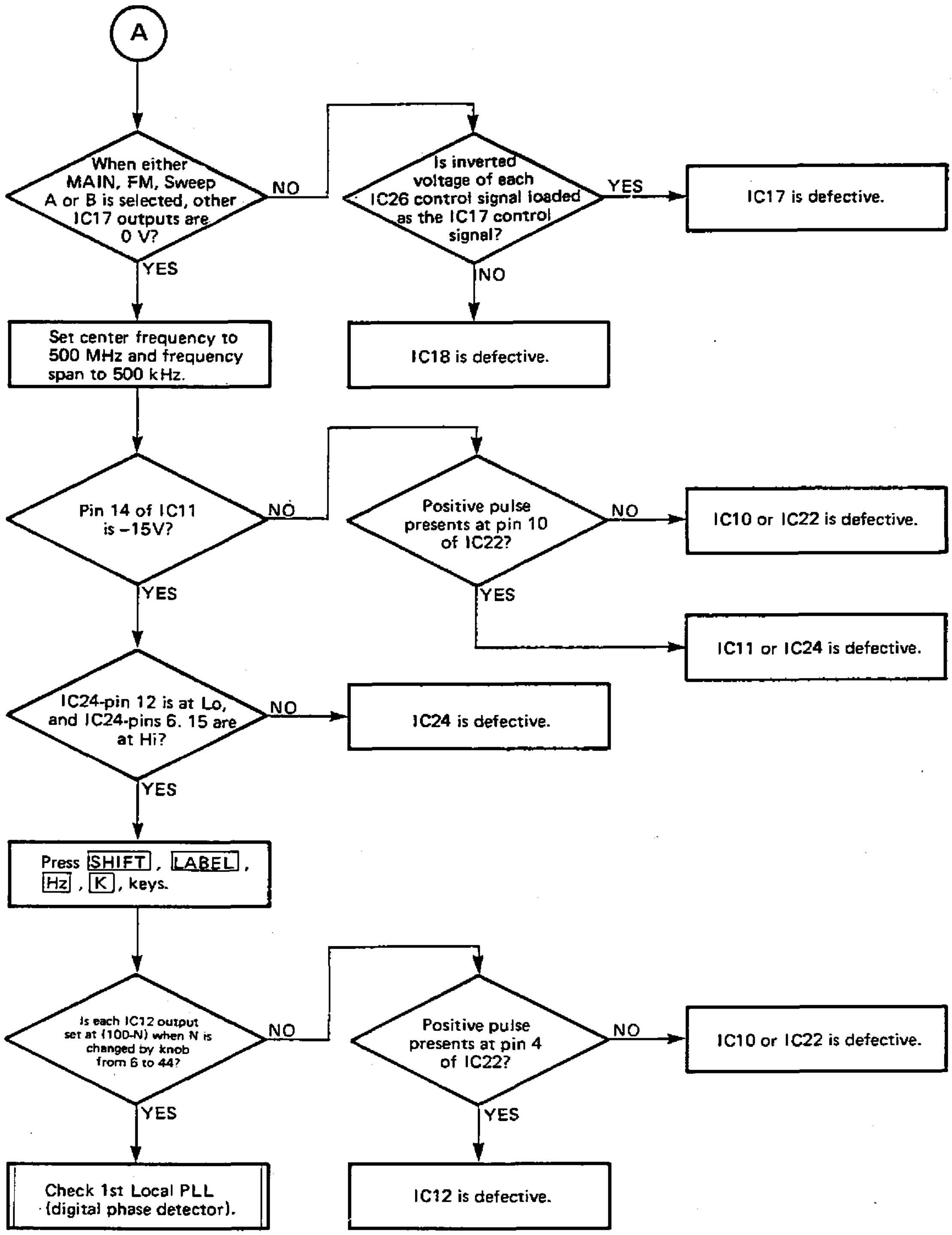
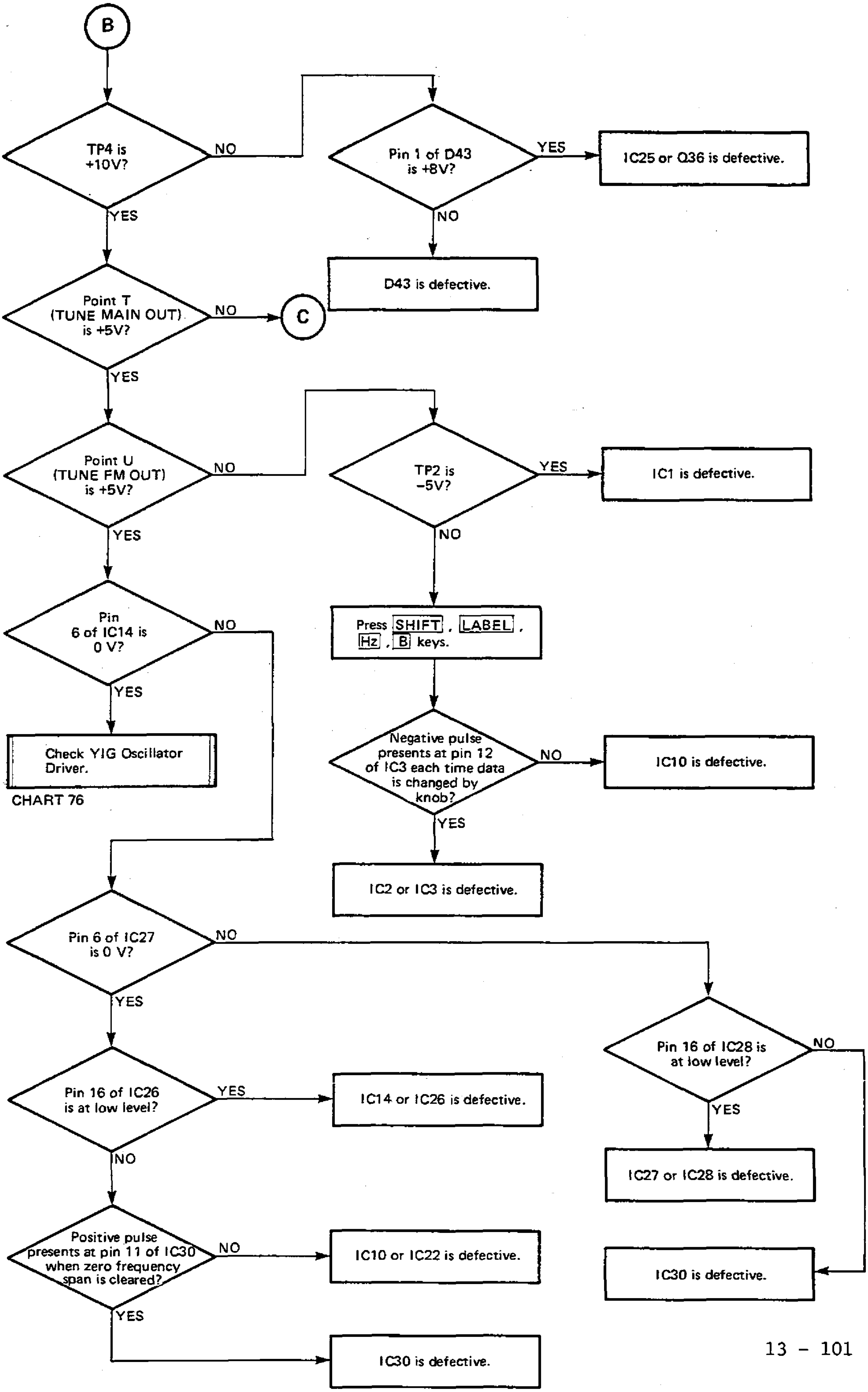
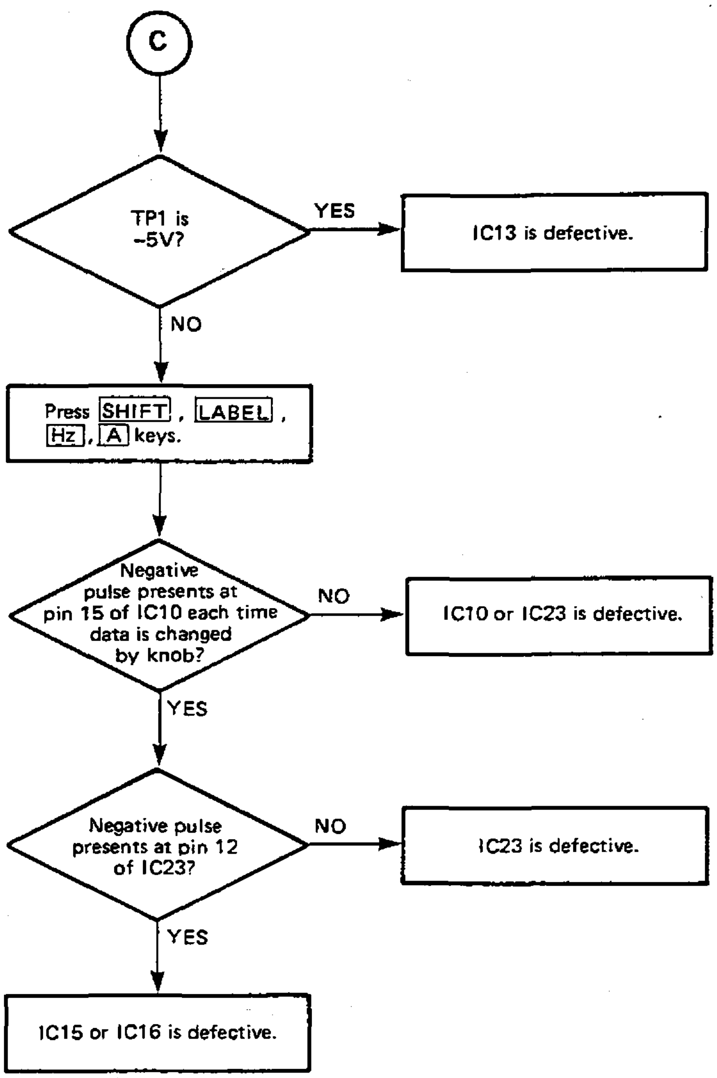

10 ms
55 ms
5 V
IC 6 – Pin 1
0 V

Fig. 77-e


A
When either MAIN, FM, Sweep A or B is selected, other IC17 outputs are 0 V?
NO
YES
Is inverted voltage of each IC26 control signal loaded as the IC17 control signal?
YES
NO
IC17 is defective.
IC18 is defective.
Set center frequency to 500 MHz and frequency span to 500 kHz.
Pin 14 of IC11 is −15V?
NO
YES
Positive pulse presents at pin 10 of IC22?
NO
YES
IC10 or IC22 is defective.
IC11 or IC24 is defective.
IC24-pin 12 is at Lo, and IC24-pins 6, 15 are at Hi?
NO
YES
IC24 is defective.
Press SHIFT, LABEL, Hz, K, keys.
Is each IC12 output set at (100-N) when N is changed by knob from 6 to 44?
NO
YES
Positive pulse presents at pin 4 of IC22?
NO
YES
IC10 or IC22 is defective.
Check 1st Local PLL (digital phase detector).
IC12 is defective.
CHART 71


B
TP4 is +10V?
NO
YES
Pin 1 of D43 is +8V?
YES
NO
IC25 or Q36 is defective.
D43 is defective.
Point T (TUNE MAIN OUT) is +5V?
NO
C
YES
Point U (TUNE FM OUT) is +5V?
NO
YES
TP2 is −5V?
YES
NO
IC1 is defective.
Press SHIFT, LABEL, Hz, B keys.
Negative pulse presents at pin 12 of IC3 each time data is changed by knob?
NO
YES
IC10 is defective.
IC2 or IC3 is defective.
Pin 6 of IC14 is 0 V?
NO
YES
Check YIG Oscillator Driver.
CHART 76
Pin 6 of IC27 is 0 V?
NO
YES
Pin 16 of IC28 is at low level?
NO
YES
IC27 or IC28 is defective.
IC30 is defective.
Pin 16 of IC26 is at low level?
YES
NO
IC14 or IC26 is defective.
Positive pulse presents at pin 11 of IC30 when zero frequency span is cleared?
NO
YES
IC10 or IC22 is defective.
IC30 is defective.


C
TP1 is -5V?
YES
IC13 is defective.
NO
Press SHIFT, LABEL, Hz, A keys.
Negative pulse presents at pin 15 of IC10 each time data is changed by knob?
NO
IC10 or IC23 is defective.
YES
Negative pulse presents at pin 12 of IC23?
NO
IC23 is defective.
YES
IC15 or IC16 is defective.

YIG I/O

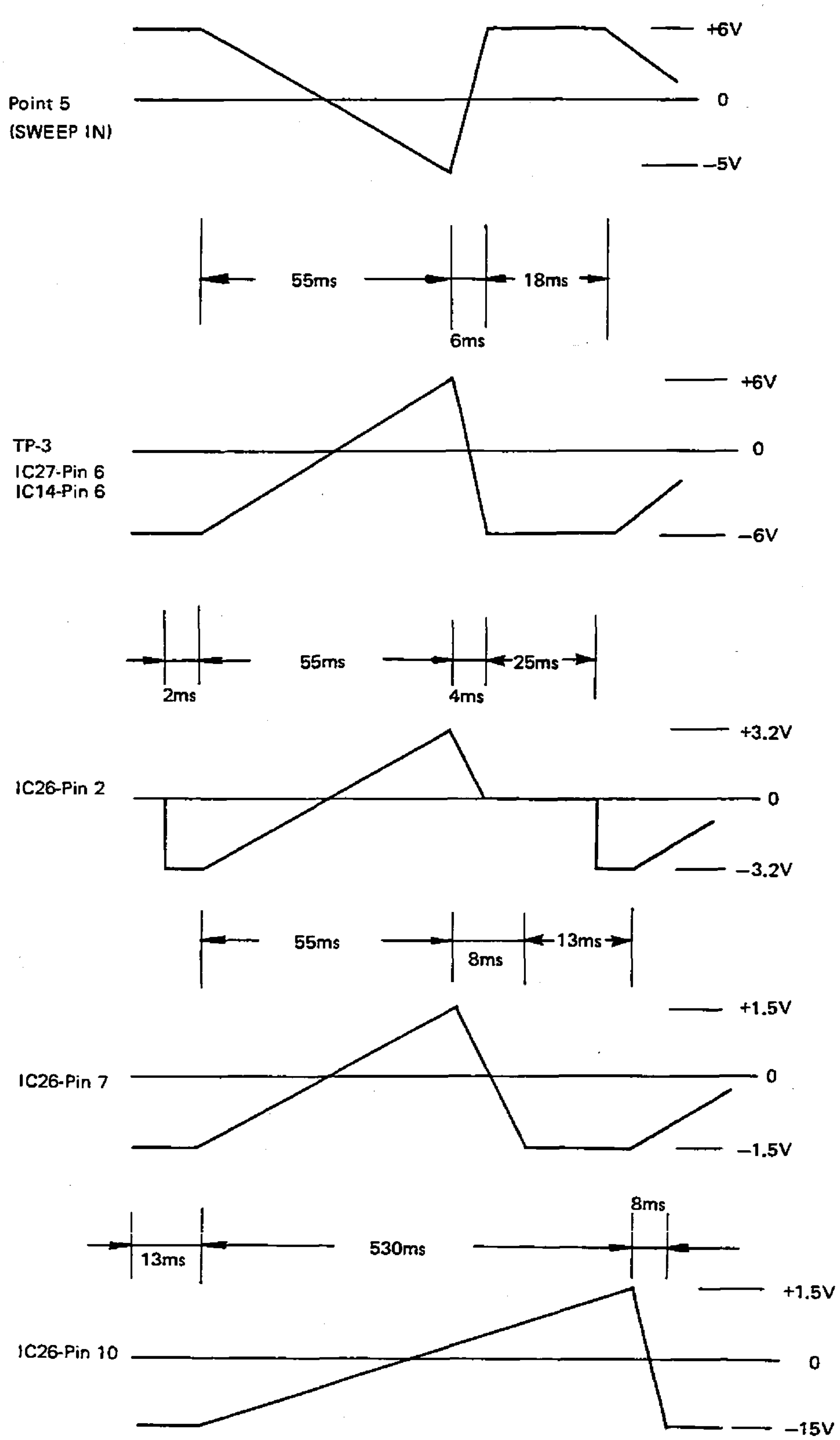


Fig. 77-a

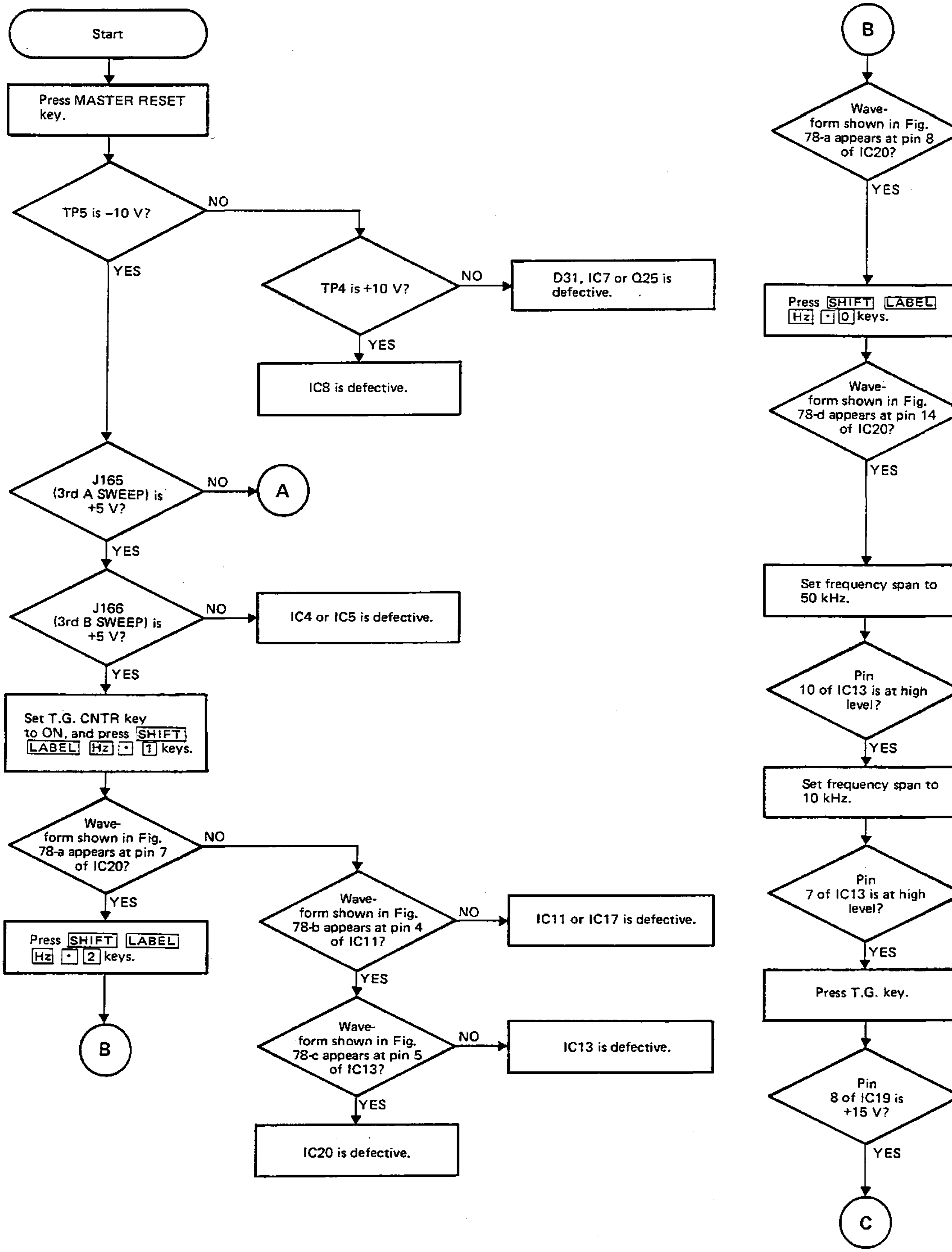
Fig. 77-a

Fig. 77-b

Fig. 77-c

Fig. 77-d

CHART 78 3rd Local I/O



NO

Wave-form shown in Fig. 78-c appears at pin 12 of IC13?

NO → IC13 is defective.

YES → IC20 is defective.

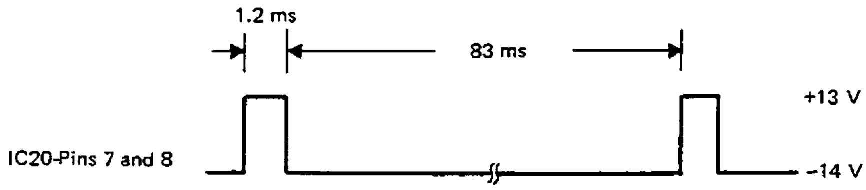


Fig. 78-a

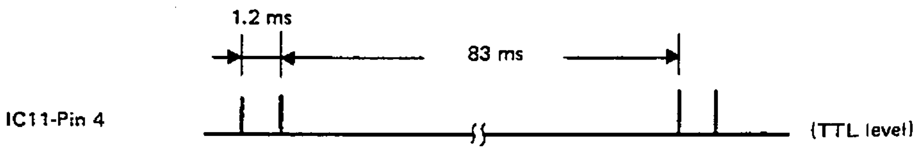


Fig. 78-b

NO

Wave-form shown in Fig. 78-e appears at pin 15 of IC13?

NO → IC13 is defective.

YES → IC20 defective.

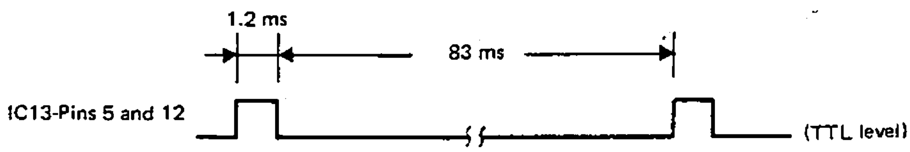


Fig. 78-c

NO → IC20 defective.

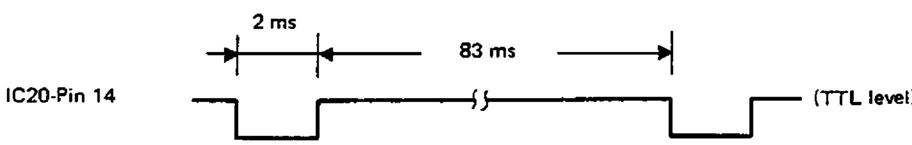


Fig. 78-d

NO → IC13 is defective.

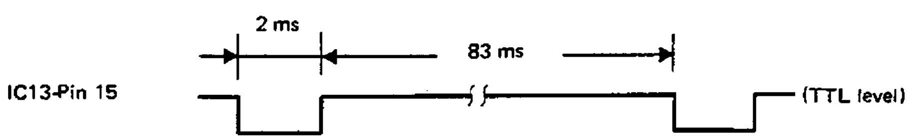


Fig. 78-e

NO

Positive pulse presents at pin 10 of IC11?

NO → IC11 or IC17 is defective.

YES → Pin 10 of IC12 is at high level?

NO → IC12 is defective.

YES → IC19 is defective.

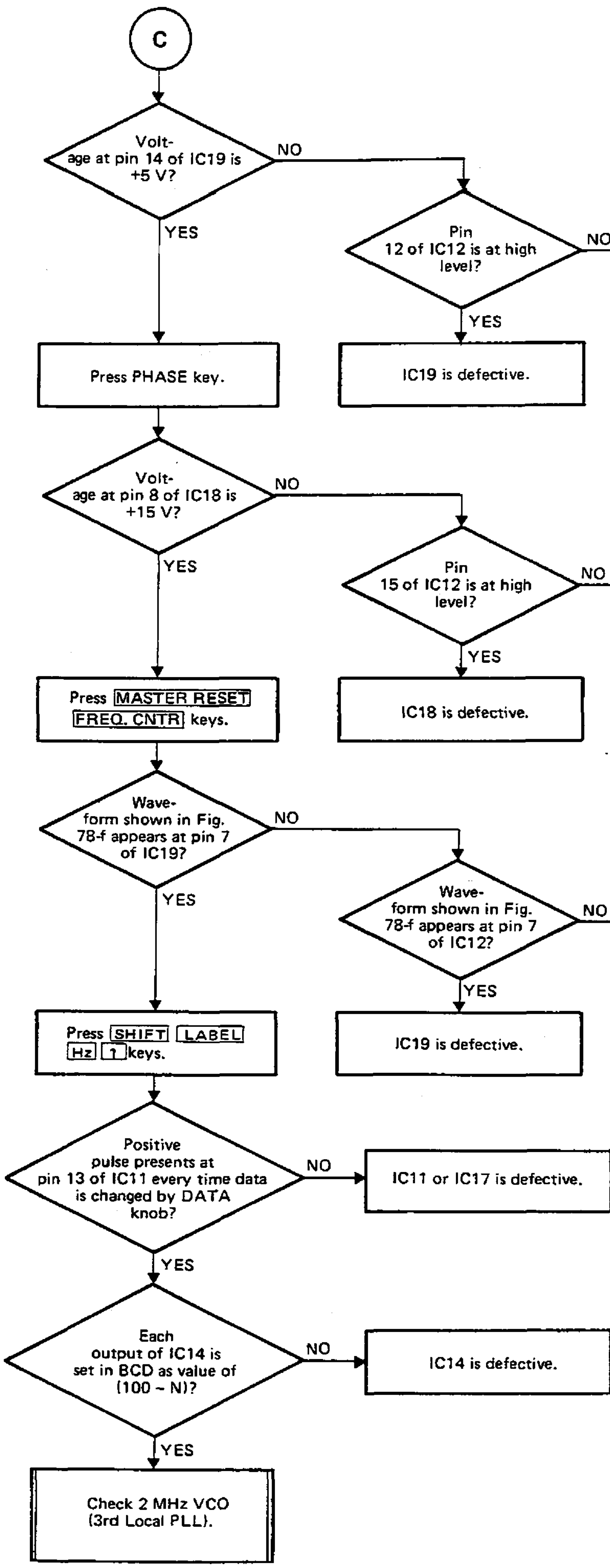
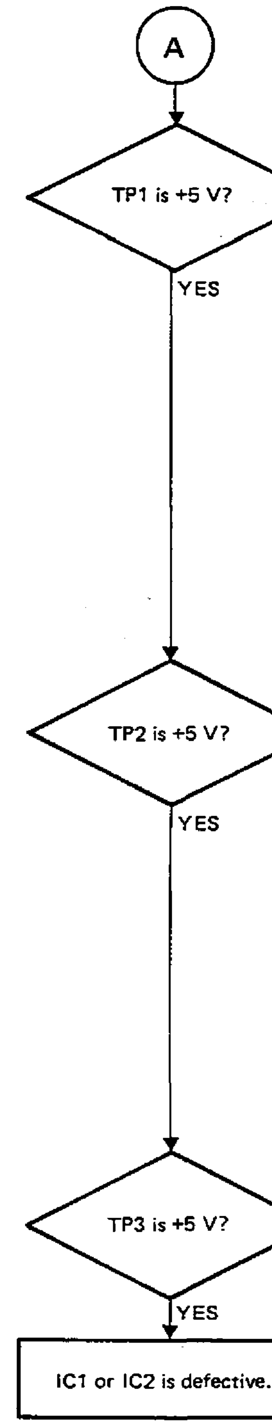


CHART 68



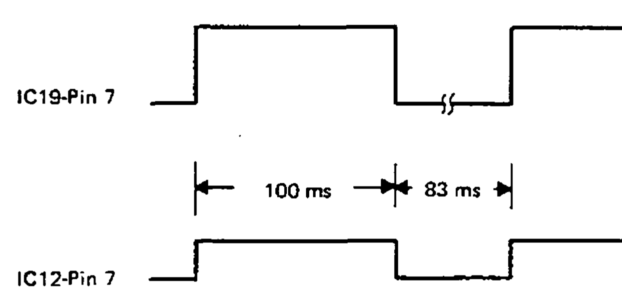


Fig. 78-f

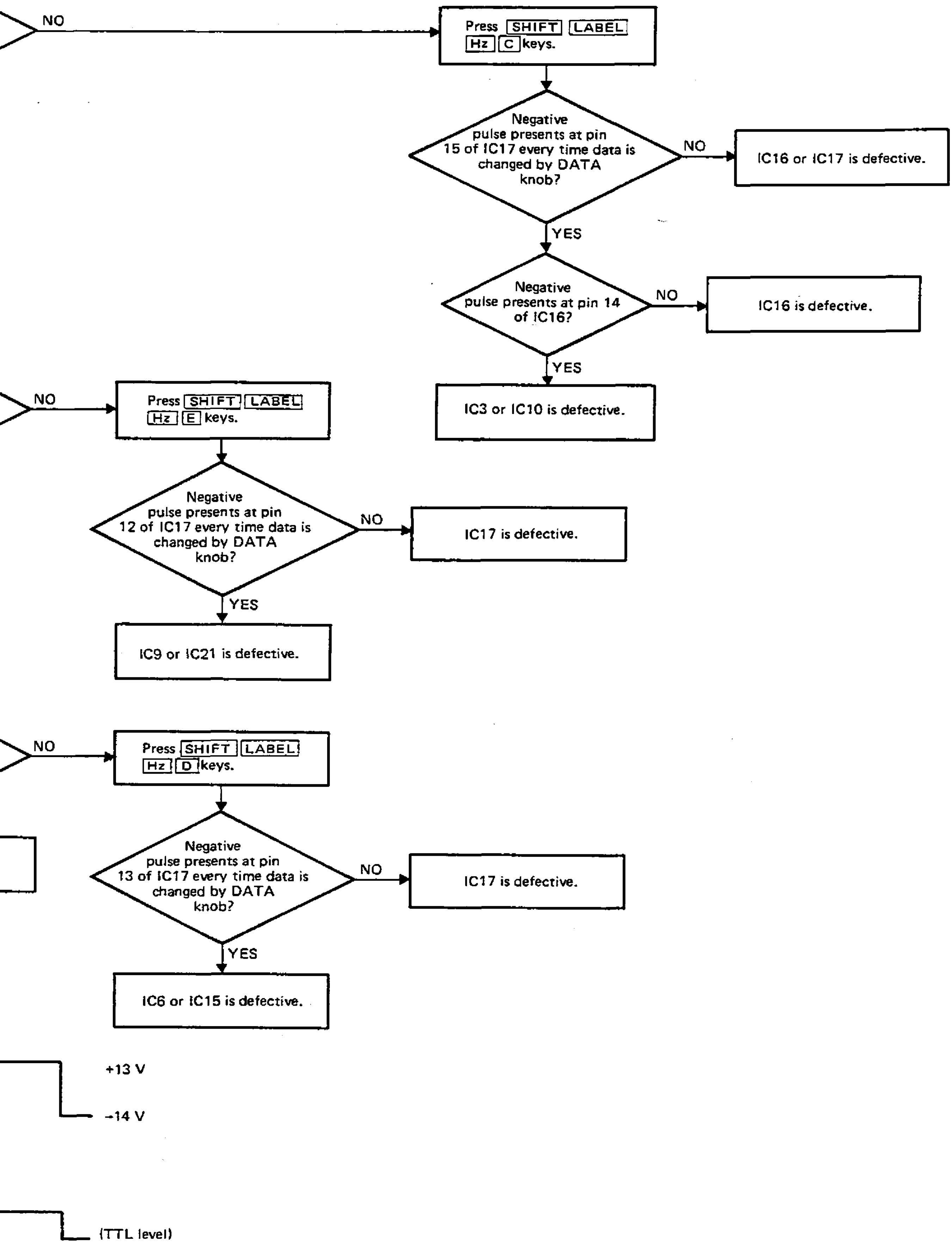

NO
Press SHIFT LABEL Hz C keys.
Negative pulse presents at pin 15 of IC17 every time data is changed by DATA knob?
NO
IC16 or IC17 is defective.
YES
Negative pulse presents at pin 14 of IC16?
NO
IC16 is defective.
YES
IC3 or IC10 is defective.
NO
Press SHIFT LABEL Hz E keys.
Negative pulse presents at pin 12 of IC17 every time data is changed by DATA knob?
NO
IC17 is defective.
YES
IC9 or IC21 is defective.
NO
Press SHIFT LABEL Hz D keys.
Negative pulse presents at pin 13 of IC17 every time data is changed by DATA knob?
NO
IC17 is defective.
YES
IC6 or IC15 is defective.
+13 V
-14 V
(TTL level)

CHART 79 ATT Driver

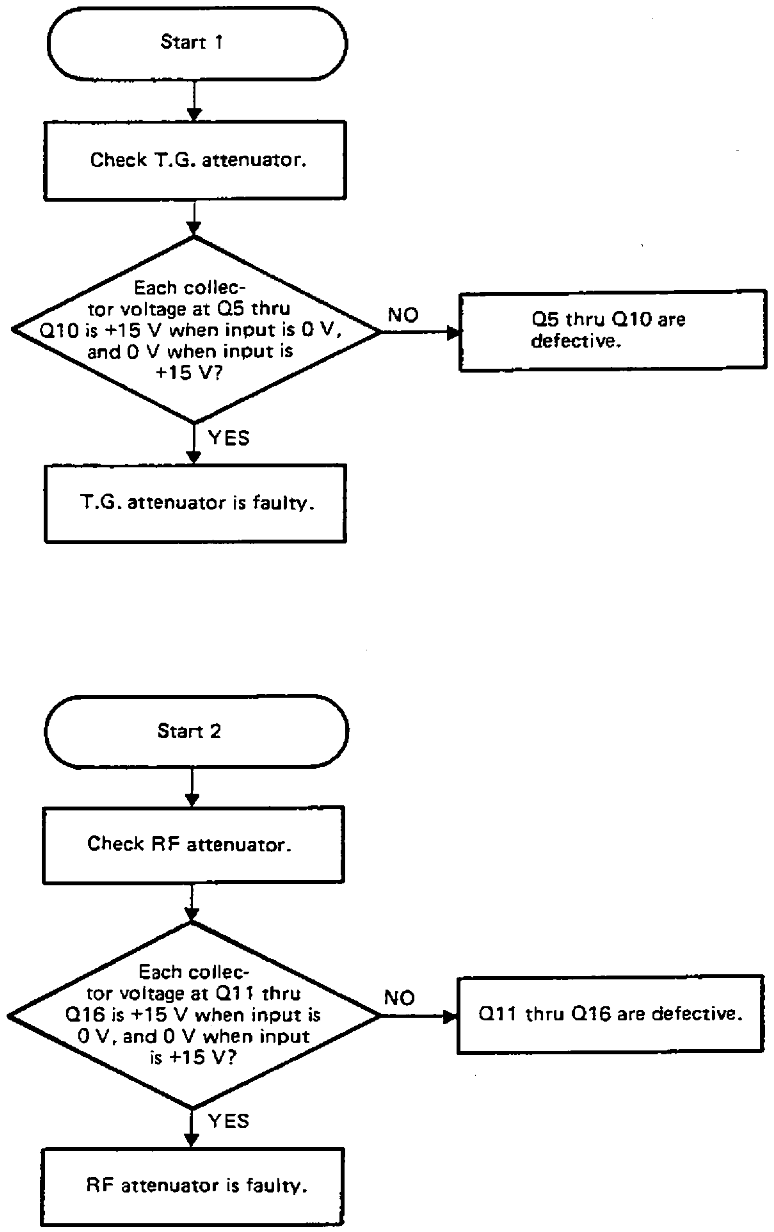
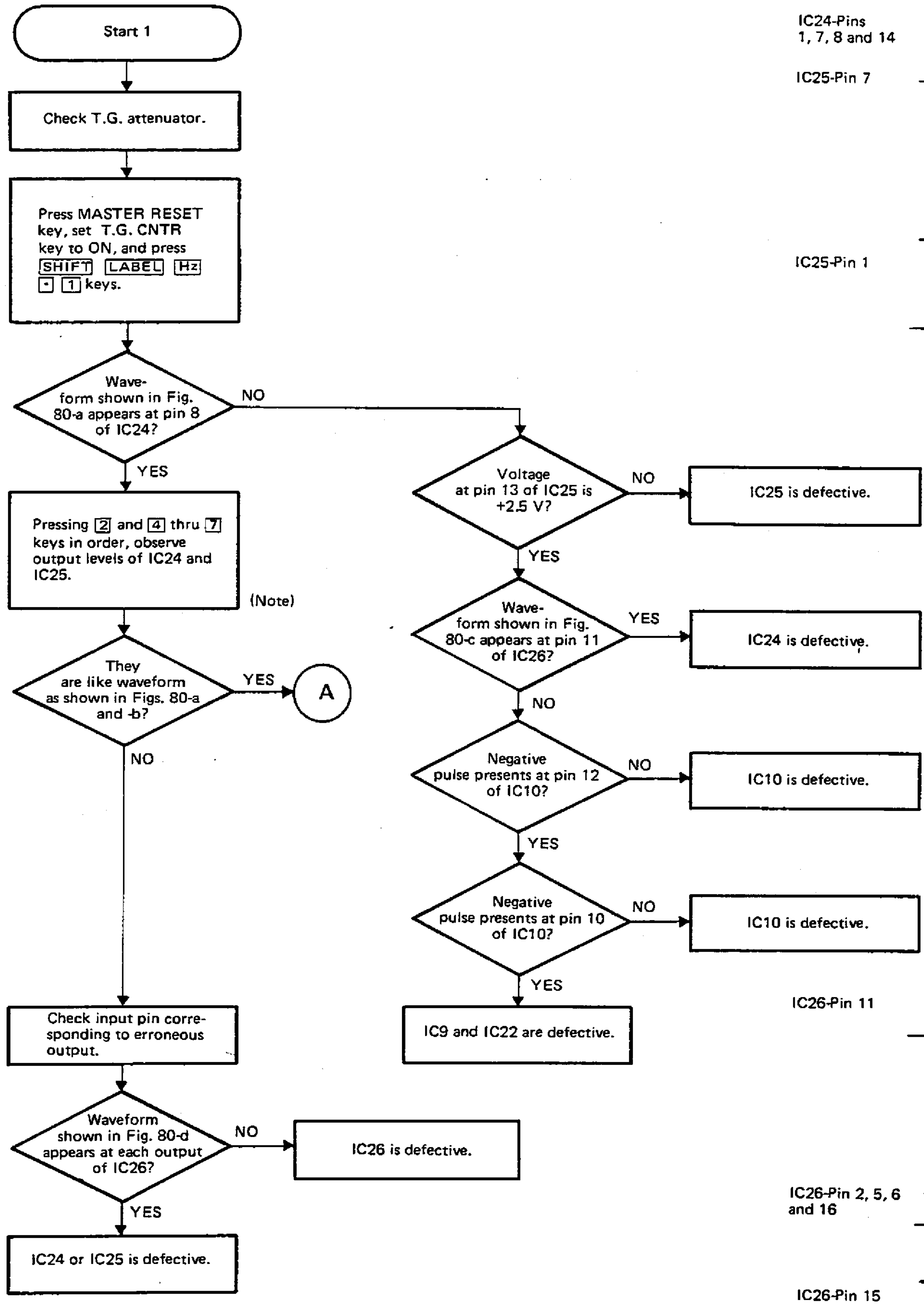


CHART 80 ATT I/O



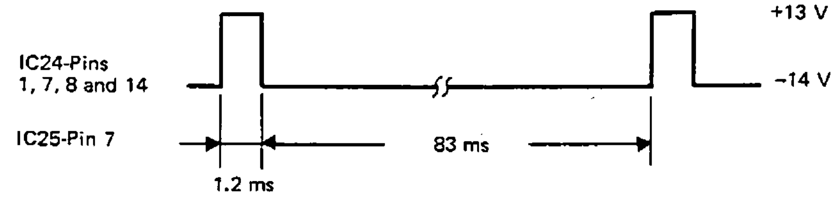


Fig. 80-a

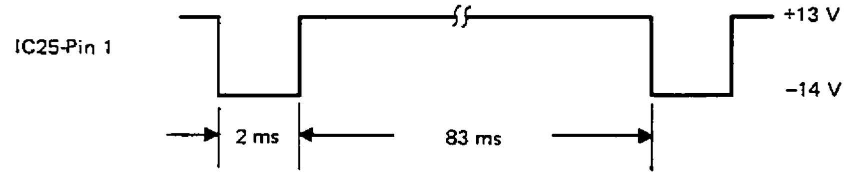


Fig. 80-b

Note: Key and output pin correspondences are as follows:

- 2 ..... IC24-Pin 1
- 4 ..... IC24-Pin 14
- 5 ..... IC25-Pin 7
- 6 ..... IC24-Pin 7
- 7 ..... IC25-Pin 1

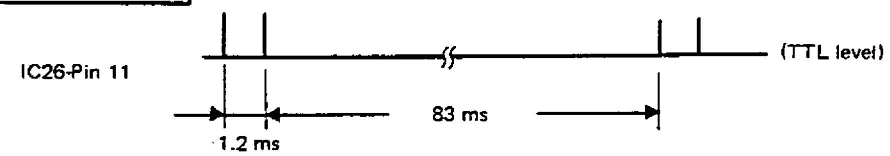


Fig. 80-c

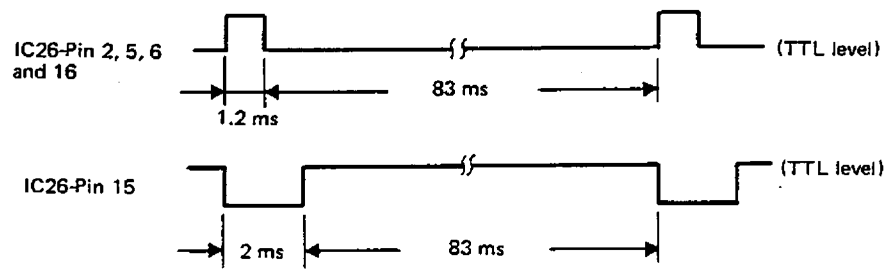


Fig. 80-d

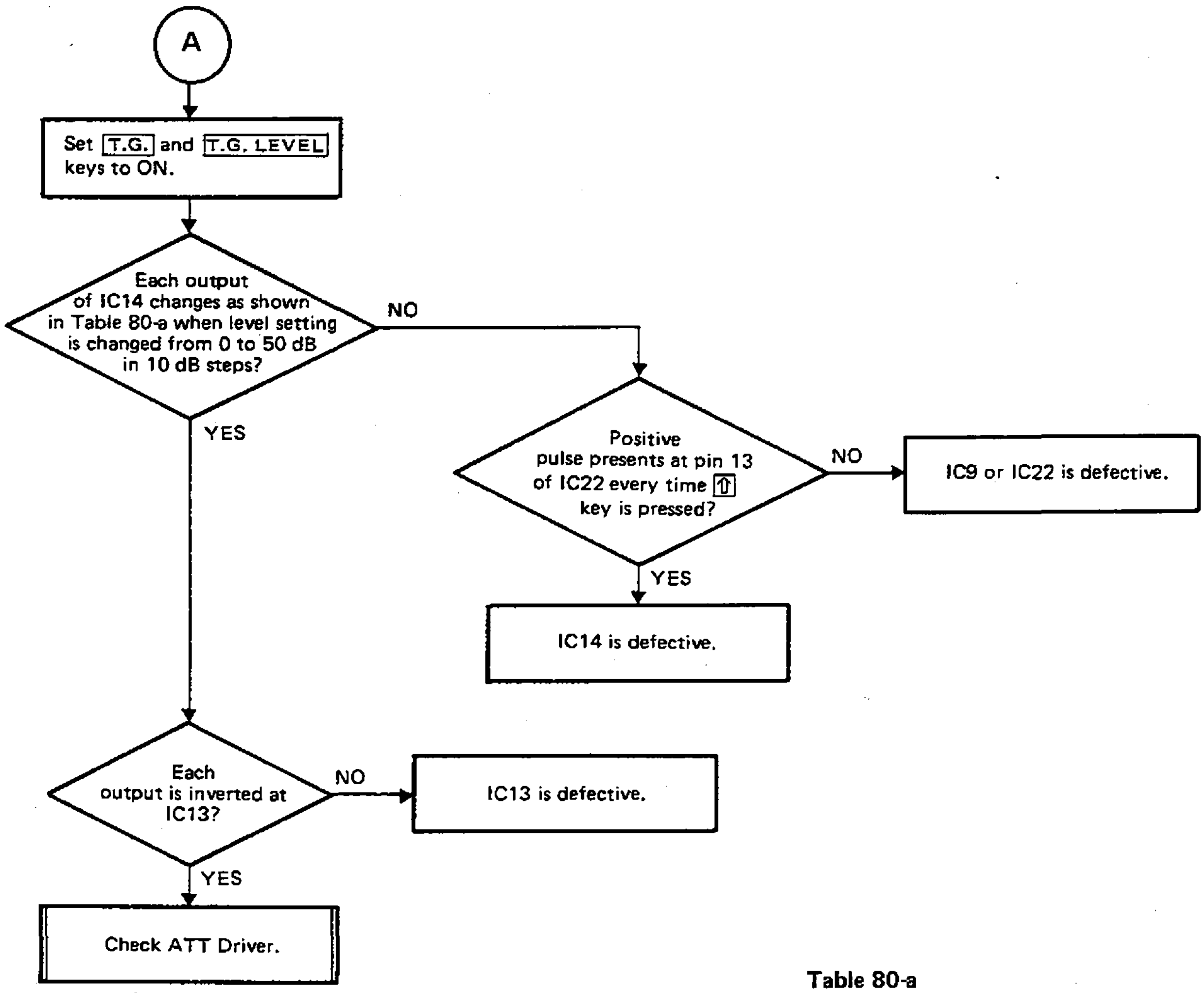
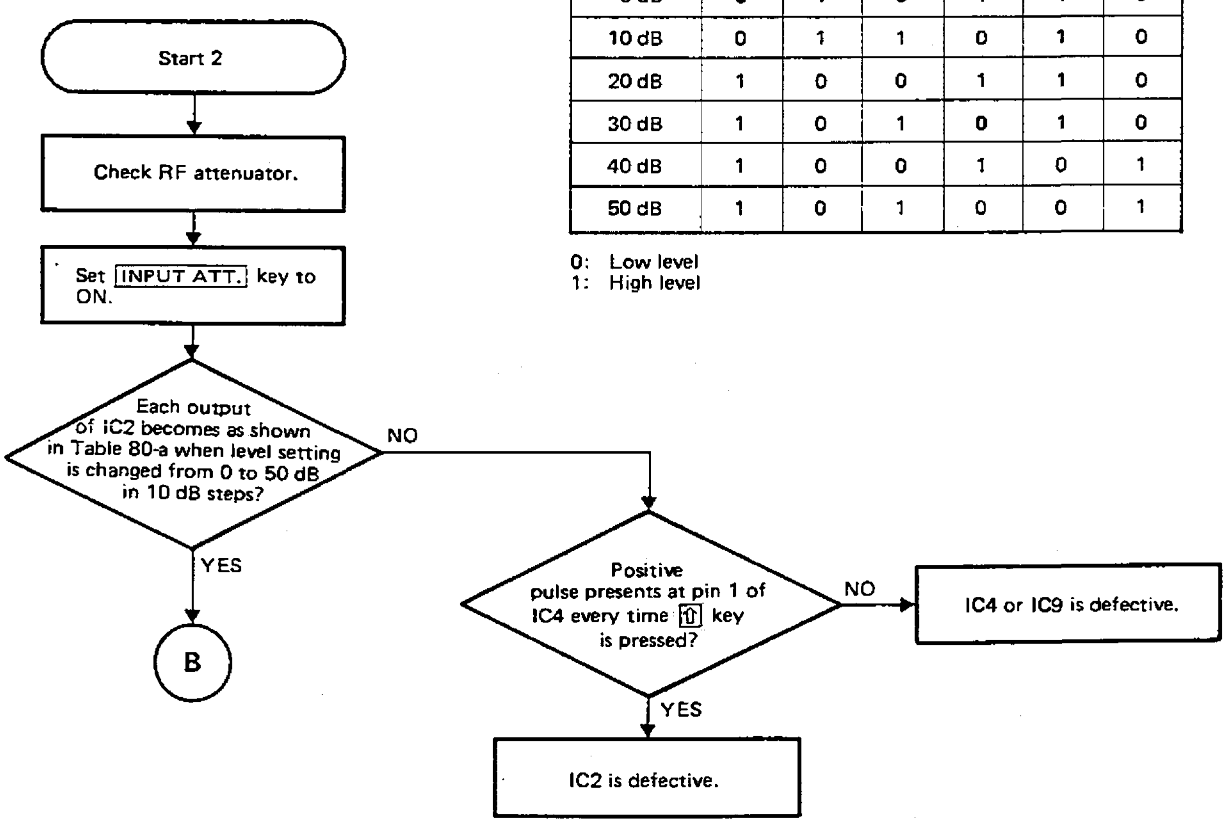


CHART 79

Table 80-a

ATT	Pin 10	Pin 7	Pin 12	Pin 5	Pin 2	Pin 15
0 dB	0	1	0	1	1	0
10 dB	0	1	1	0	1	0
20 dB	1	0	0	1	1	0
30 dB	1	0	1	0	1	0
40 dB	1	0	0	1	0	1
50 dB	1	0	1	0	0	1

0: Low level
1: High level



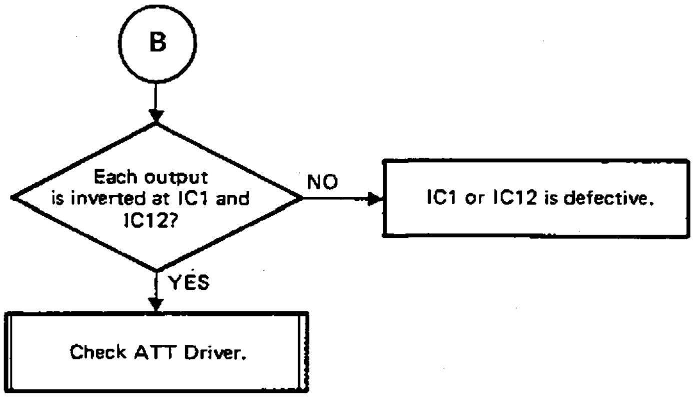
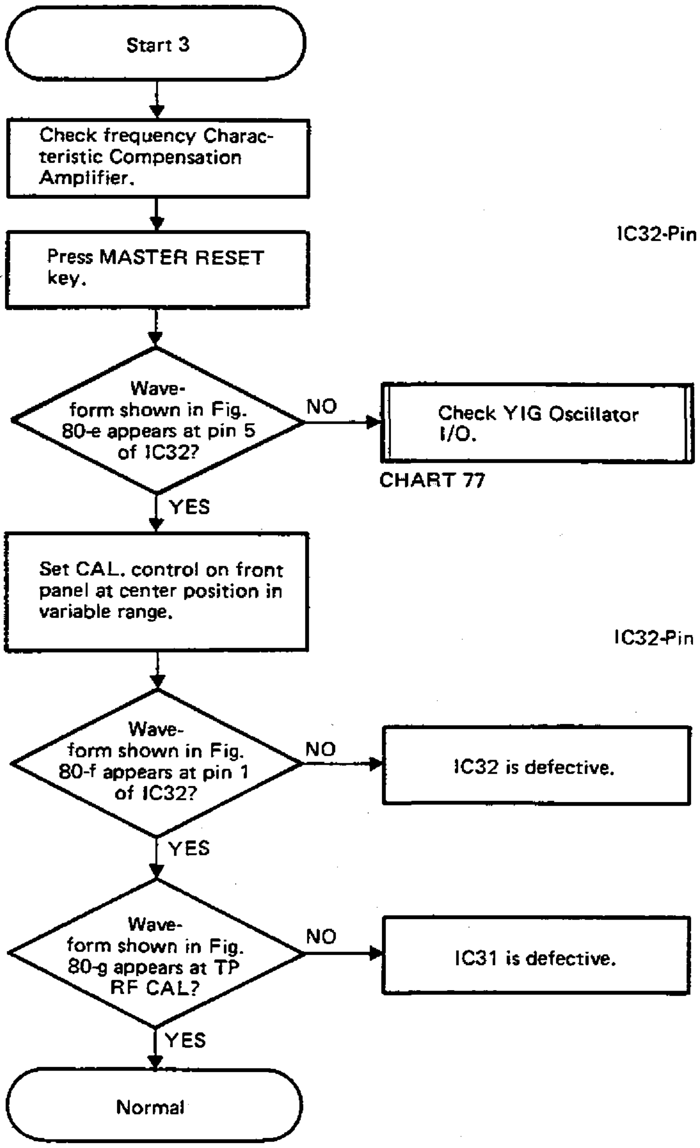


CHART 79



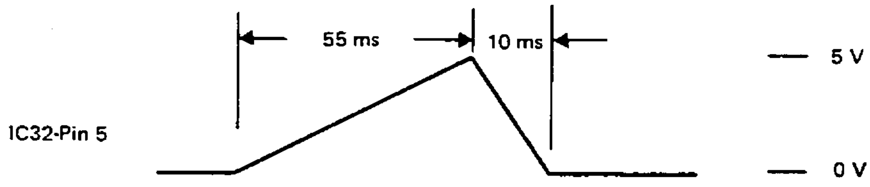


Fig. 80-e

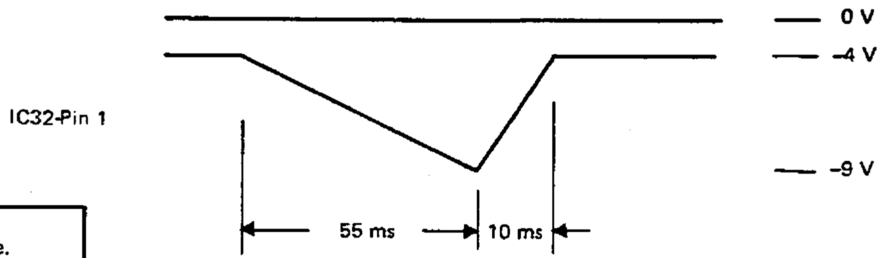


Fig. 80-f

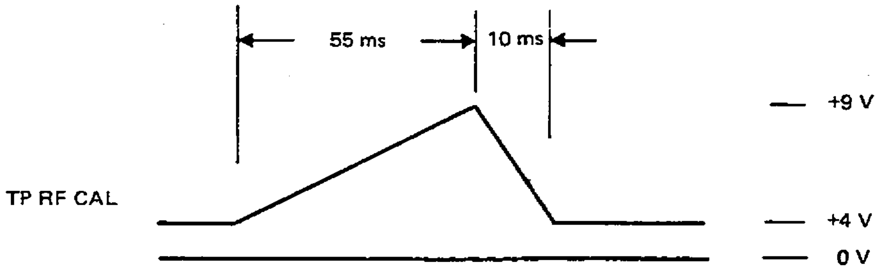


Fig. 80-g

CHART 81 Tracking Generator

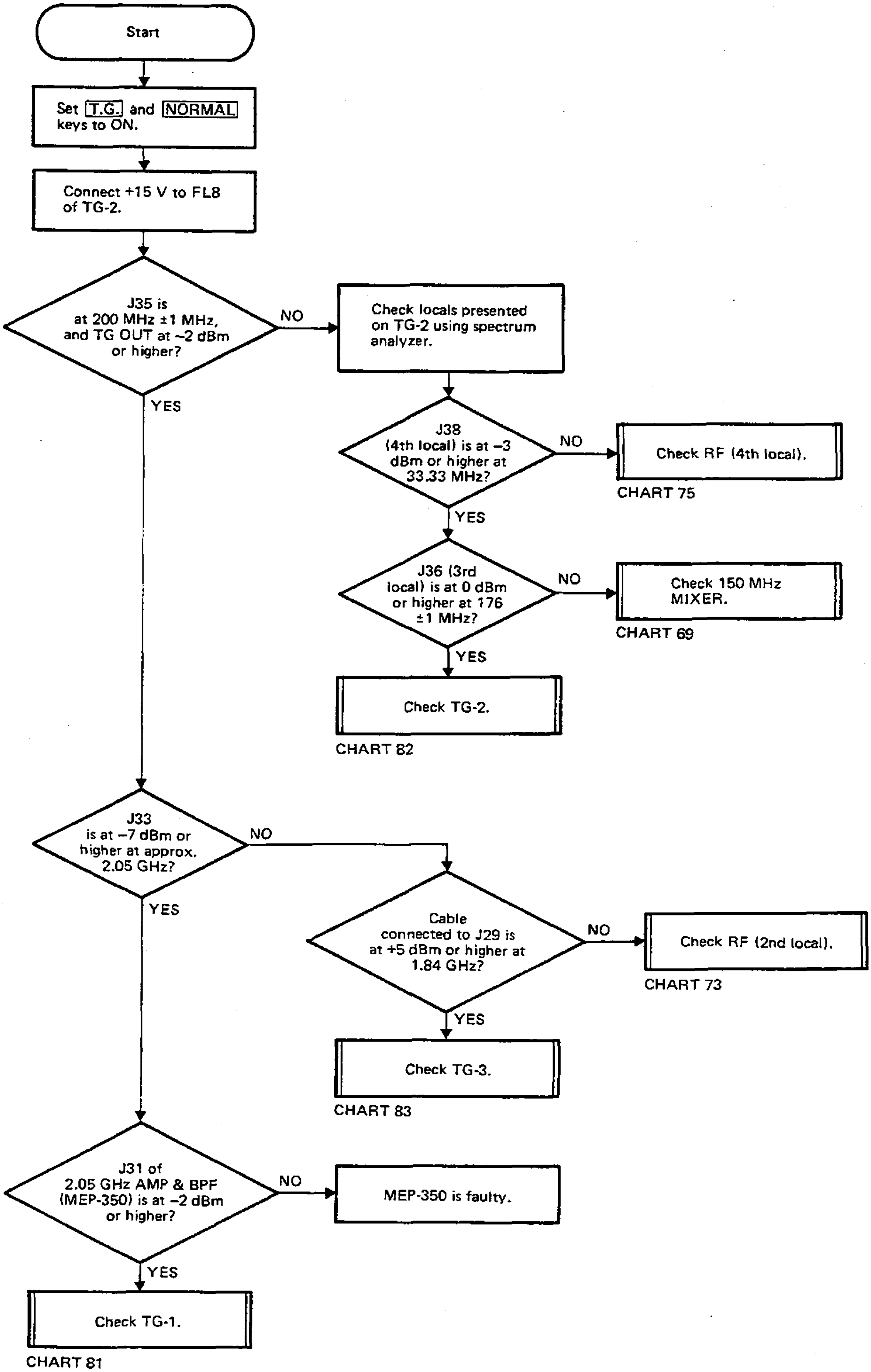


CHART 82 Tracking Generator 2

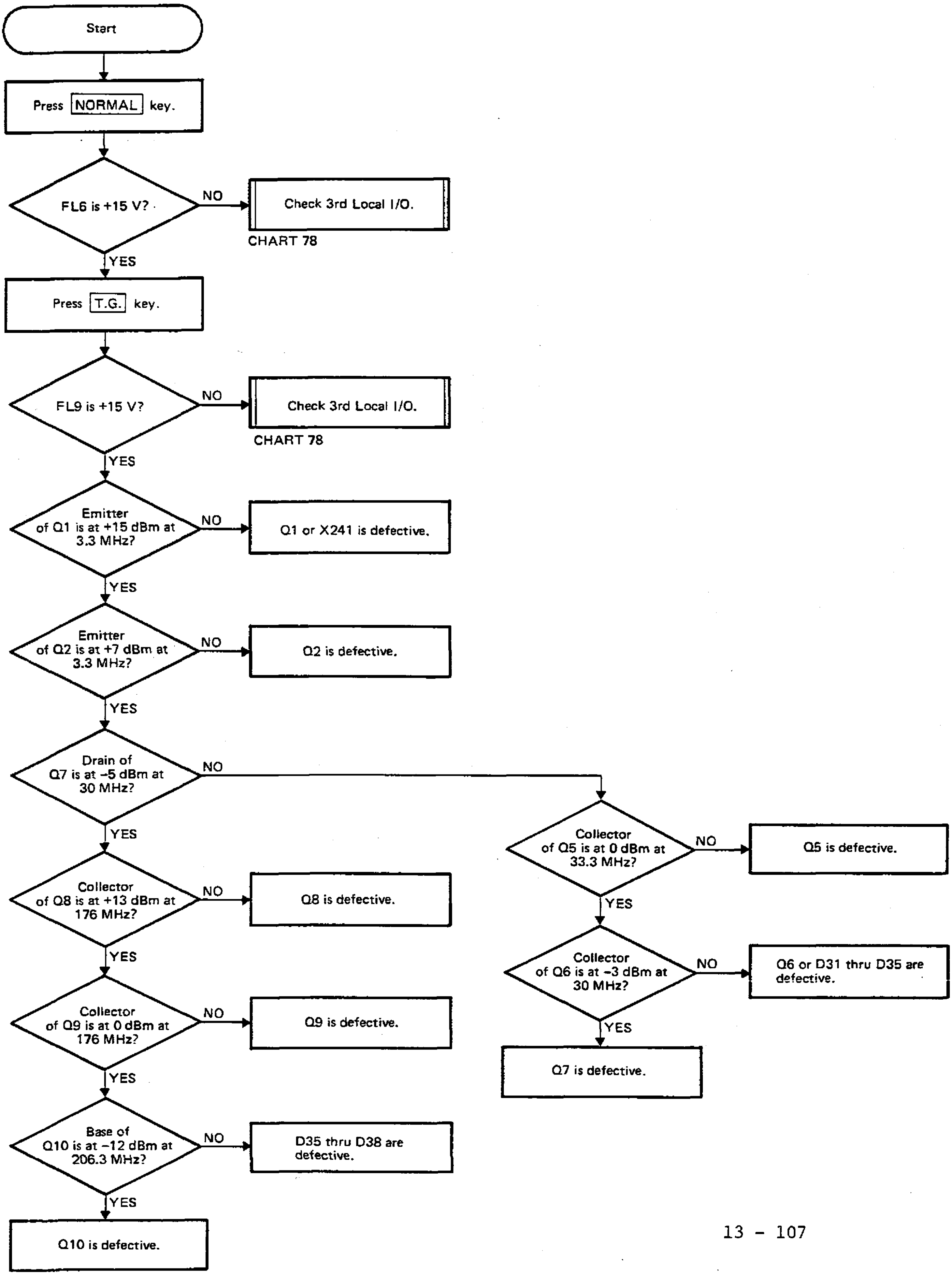


CHART 83 Tracking Generator 3

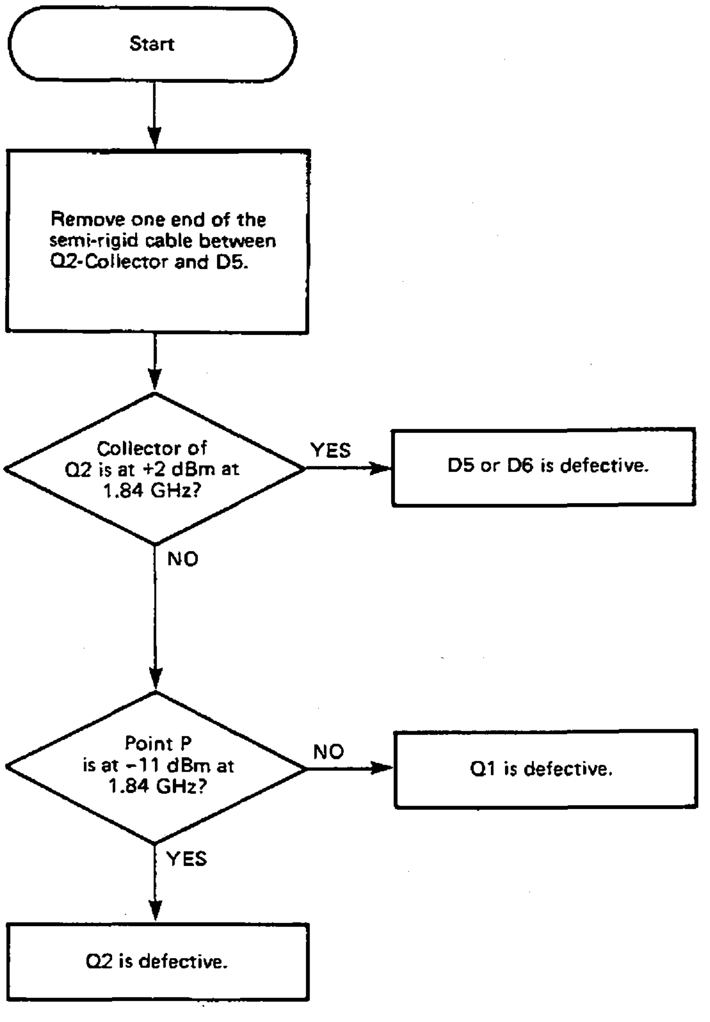


CHART 84 Tracking Generator I

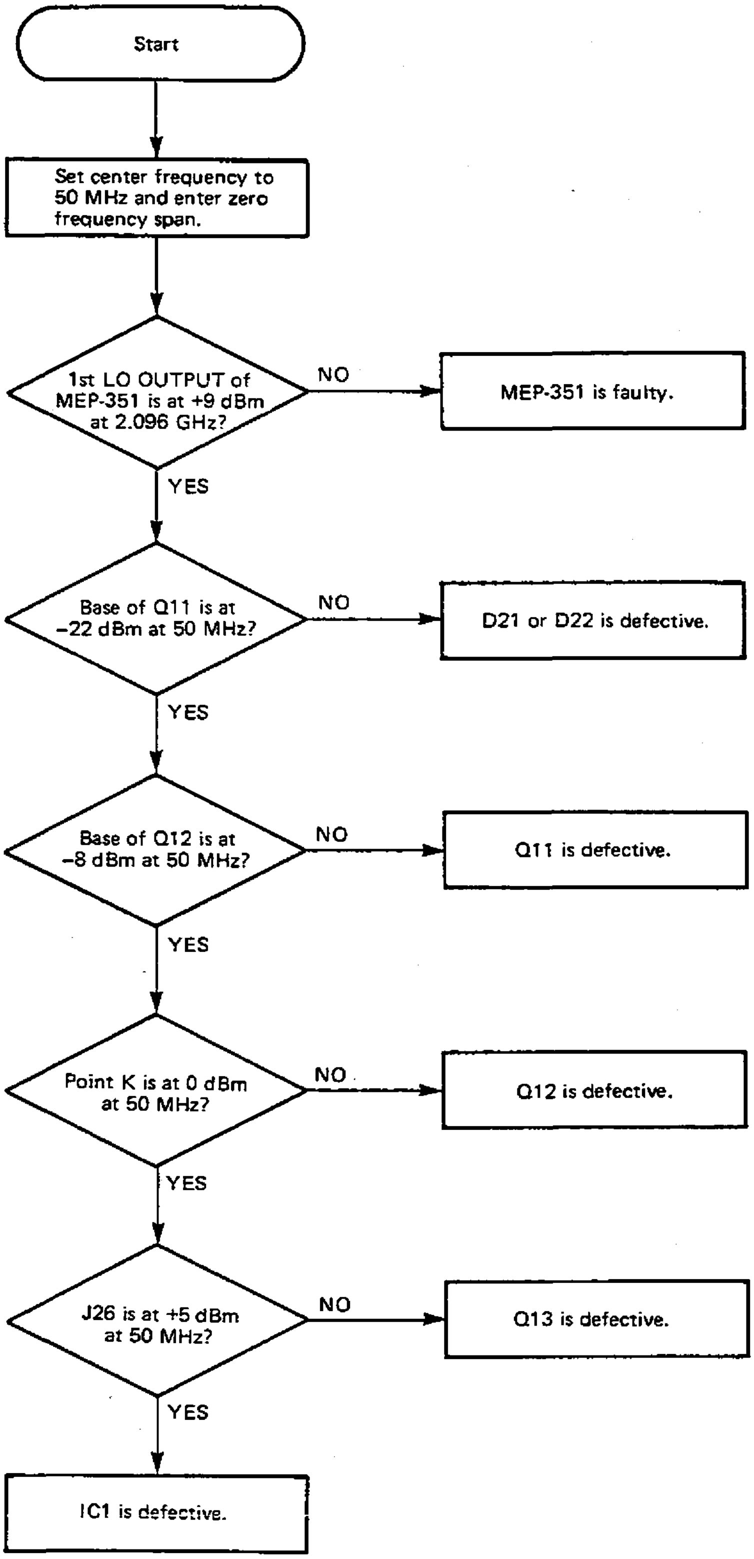
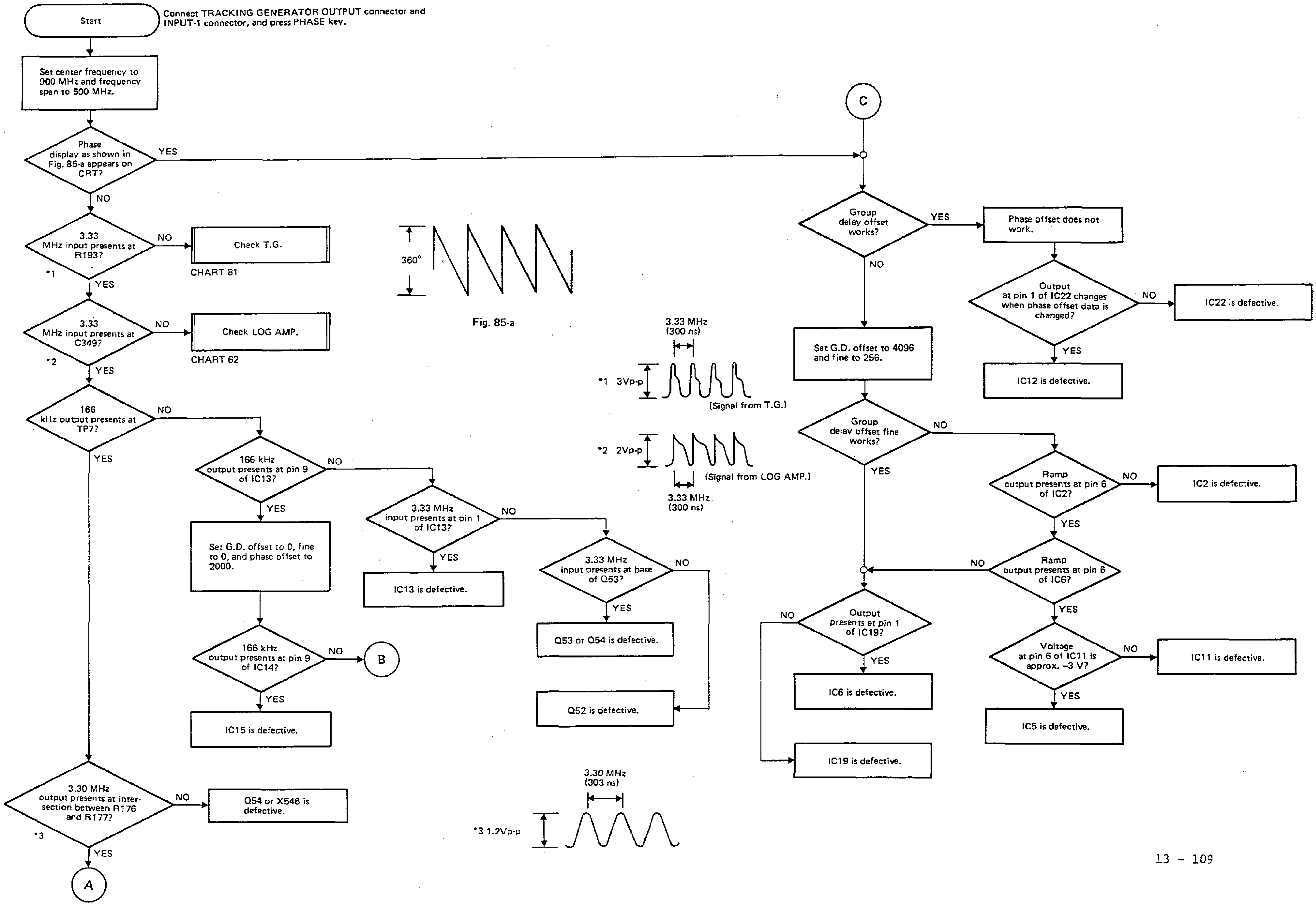
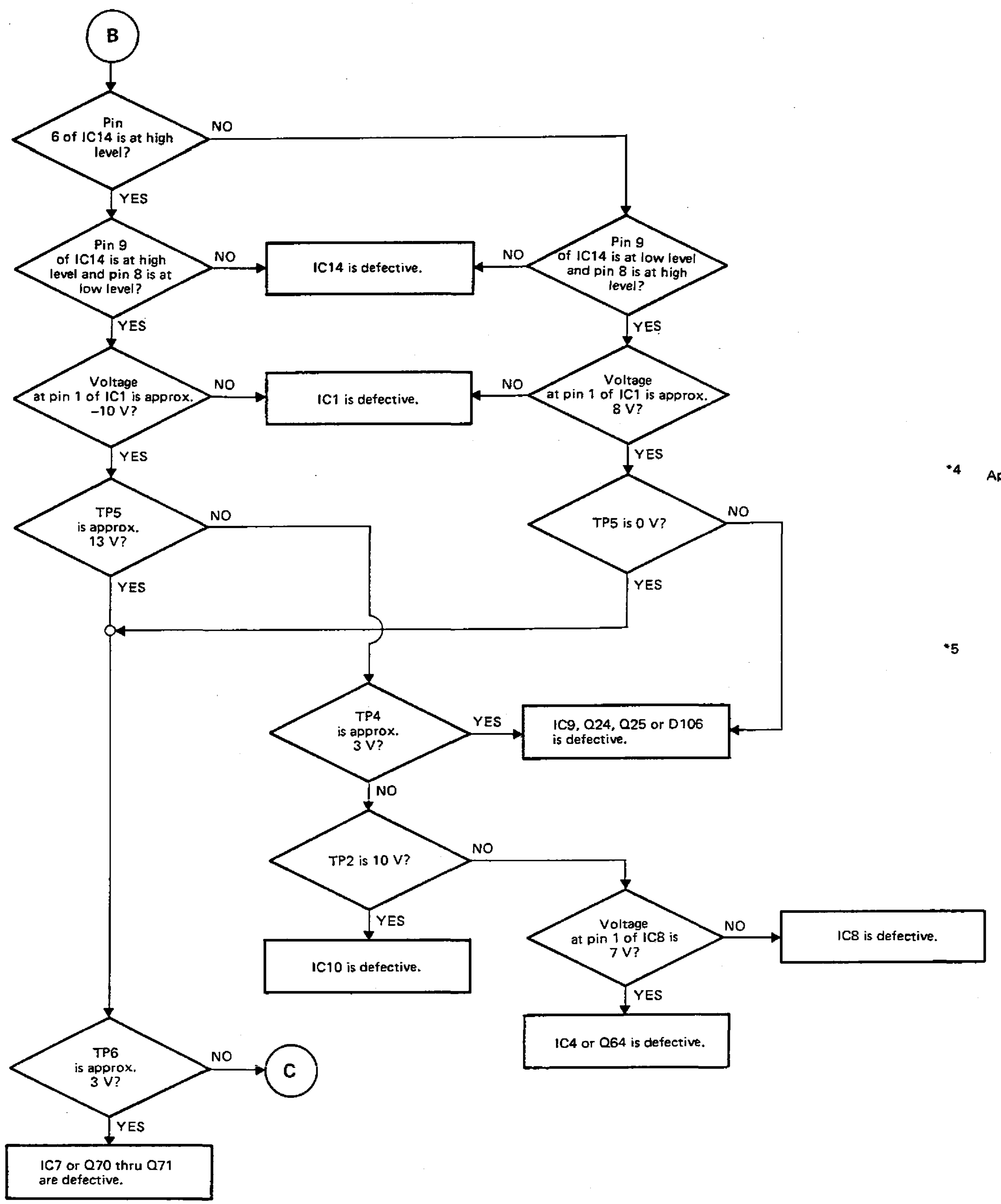
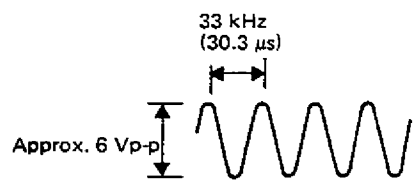
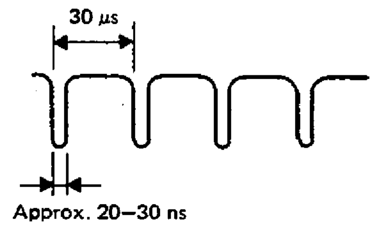


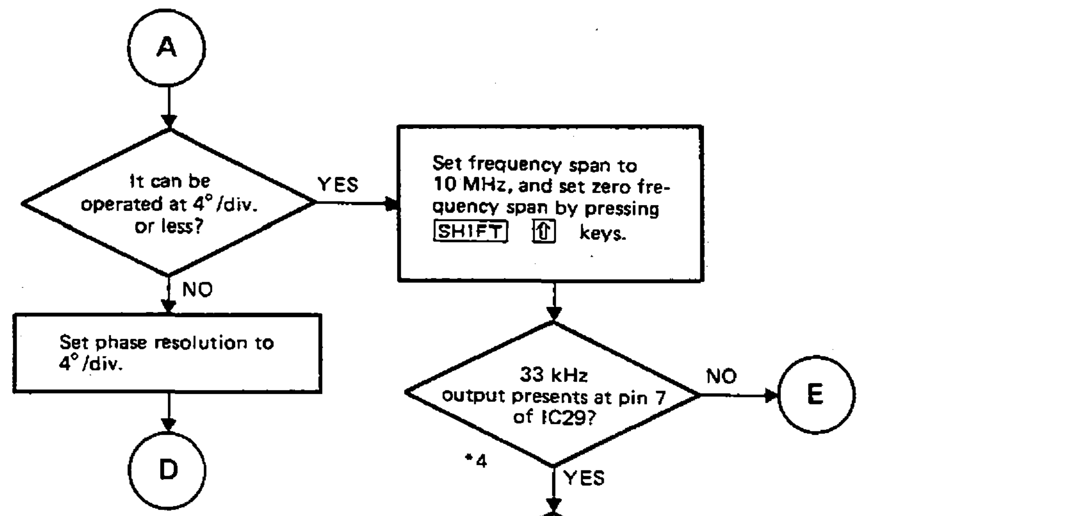
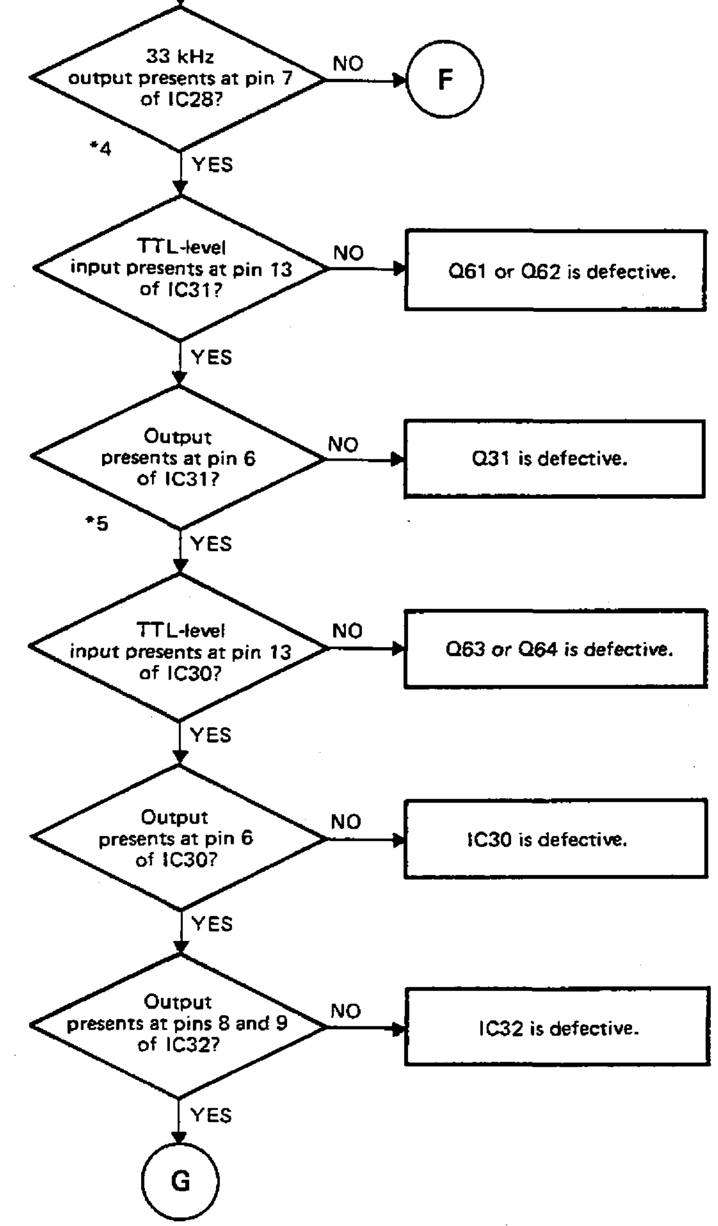
CHART 85 Phase

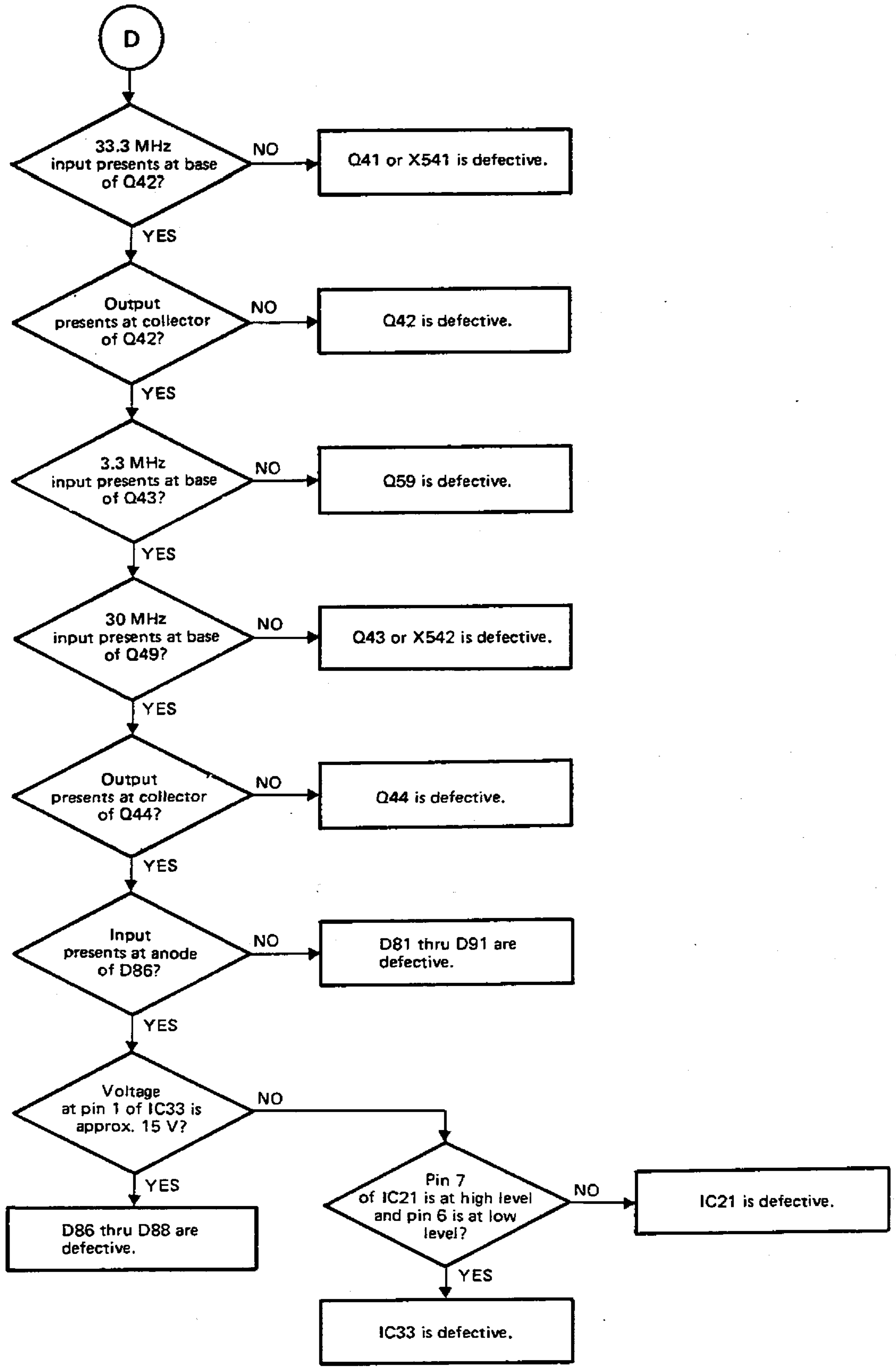


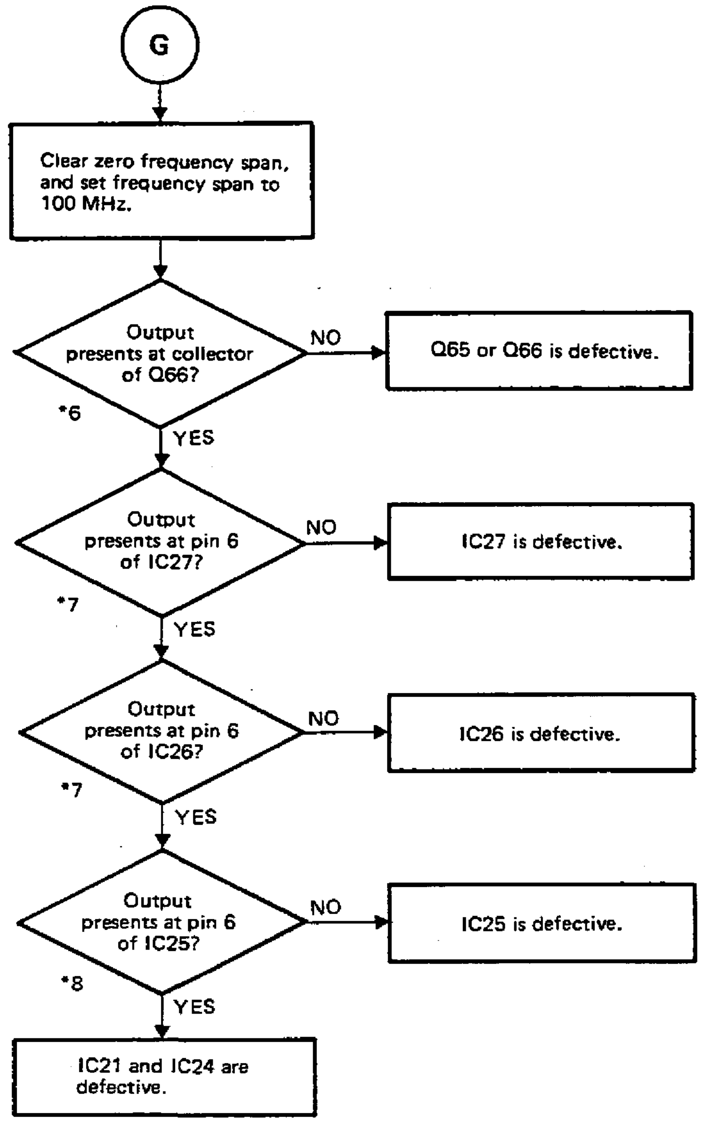

B
Pin 6 of IC14 is at high level?
NO
YES
Pin 9 of IC14 is at high level and pin 8 is at low level?
IC14 is defective.
Pin 9 of IC14 is at low level and pin 8 is at high level?
Voltage at pin 1 of IC1 is approx. −10 V?
IC1 is defective.
Voltage at pin 1 of IC1 is approx. 8 V?
TP5 is approx. 13 V?
TP5 is 0 V?
TP4 is approx. 3 V?
IC9, Q24, Q25 or D106 is defective.
TP2 is 10 V?
IC10 is defective.
Voltage at pin 1 of IC8 is 7 V?
IC8 is defective.
IC4 or Q64 is defective.
TP6 is approx. 3 V?
C
IC7 or Q70 thru Q71 are defective.

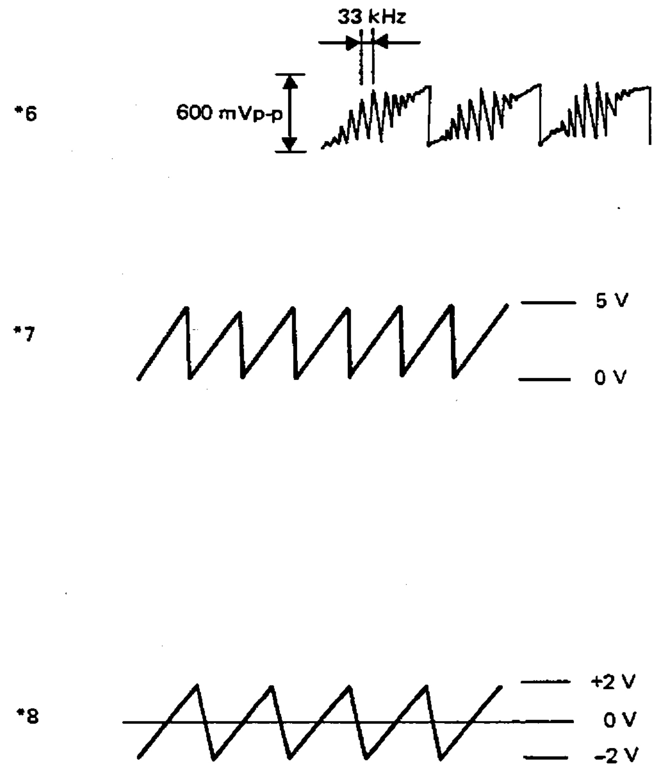
*4

33 kHz (30.3 μs)
Approx. 6 Vp-p

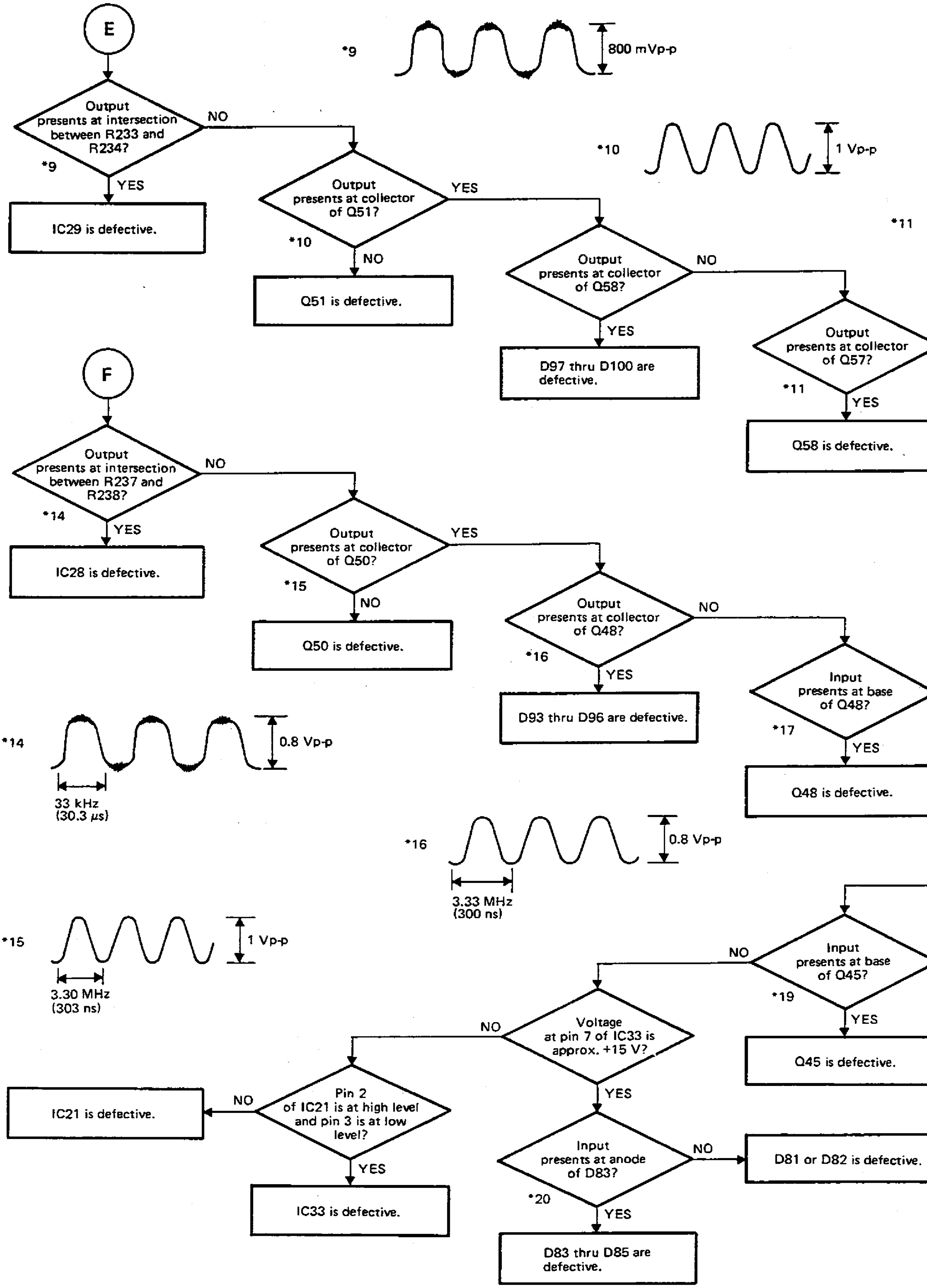
*5

30 μs
Approx. 20–30 ns



A
It can be operated at 4°/div. or less?
YES
NO
Set frequency span to 10 MHz, and set zero frequency span by pressing SHIFT ⇧ keys.
Set phase resolution to 4°/div.
D
33 kHz output presents at pin 7 of IC29?
*4
E
33 kHz output presents at pin 7 of IC28?
F
TTL-level input presents at pin 13 of IC31?
Q61 or Q62 is defective.
Output presents at pin 6 of IC31?
*5
Q31 is defective.
TTL-level input presents at pin 13 of IC30?
Q63 or Q64 is defective.
Output presents at pin 6 of IC30?
IC30 is defective.
Output presents at pins 8 and 9 of IC32?
IC32 is defective.
G


D
33.3 MHz input presents at base of Q42?
NO
Q41 or X541 is defective.
YES
Output presents at collector of Q42?
NO
Q42 is defective.
YES
3.3 MHz input presents at base of Q43?
NO
Q59 is defective.
YES
30 MHz input presents at base of Q49?
NO
Q43 or X542 is defective.
YES
Output presents at collector of Q44?
NO
Q44 is defective.
YES
Input presents at anode of D86?
NO
D81 thru D91 are defective.
YES
Voltage at pin 1 of IC33 is approx. 15 V?
YES
D86 thru D88 are defective.
NO
Pin 7 of IC21 is at high level and pin 6 is at low level?
NO
IC21 is defective.
YES
IC33 is defective.


G
Clear zero frequency span, and set frequency span to 100 MHz.
Output presents at collector of Q66?
*6
NO
Q65 or Q66 is defective.
YES
Output presents at pin 6 of IC27?
*7
NO
IC27 is defective.
YES
Output presents at pin 6 of IC26?
*7
NO
IC26 is defective.
YES
Output presents at pin 6 of IC25?
*8
NO
IC25 is defective.
YES
IC21 and IC24 are defective.


*6
33 kHz
600 mVp-p
*7
5 V
0 V
*8
+2 V
0 V
-2 V


E
Output presents at intersection between R233 and R234?
*9
YES
NO
IC29 is defective.
*9
800 mVp-p
Output presents at collector of Q51?
*10
YES
NO
Q51 is defective.
*10
1 Vp-p
*11
Output presents at collector of Q58?
NO
YES
D97 thru D100 are defective.
Output presents at collector of Q57?
*11
YES
Q58 is defective.
F
Output presents at intersection between R237 and R238?
*14
YES
NO
IC28 is defective.
Output presents at collector of Q50?
*15
YES
NO
Q50 is defective.
Output presents at collector of Q48?
*16
NO
YES
D93 thru D96 are defective.
Input presents at base of Q48?
*17
YES
Q48 is defective.
*14
0.8 Vp-p
33 kHz
(30.3 μs)
*16
0.8 Vp-p
3.33 MHz
(300 ns)
*15
1 Vp-p
3.30 MHz
(303 ns)
Input presents at base of Q45?
*19
NO
YES
Q45 is defective.
Voltage at pin 7 of IC33 is approx. +15 V?
NO
YES
Pin 2 of IC21 is at high level and pin 3 is at low level?
NO
YES
IC21 is defective.
IC33 is defective.
Input presents at anode of D83?
*20
NO
YES
D81 or D82 is defective.
D83 thru D85 are defective.

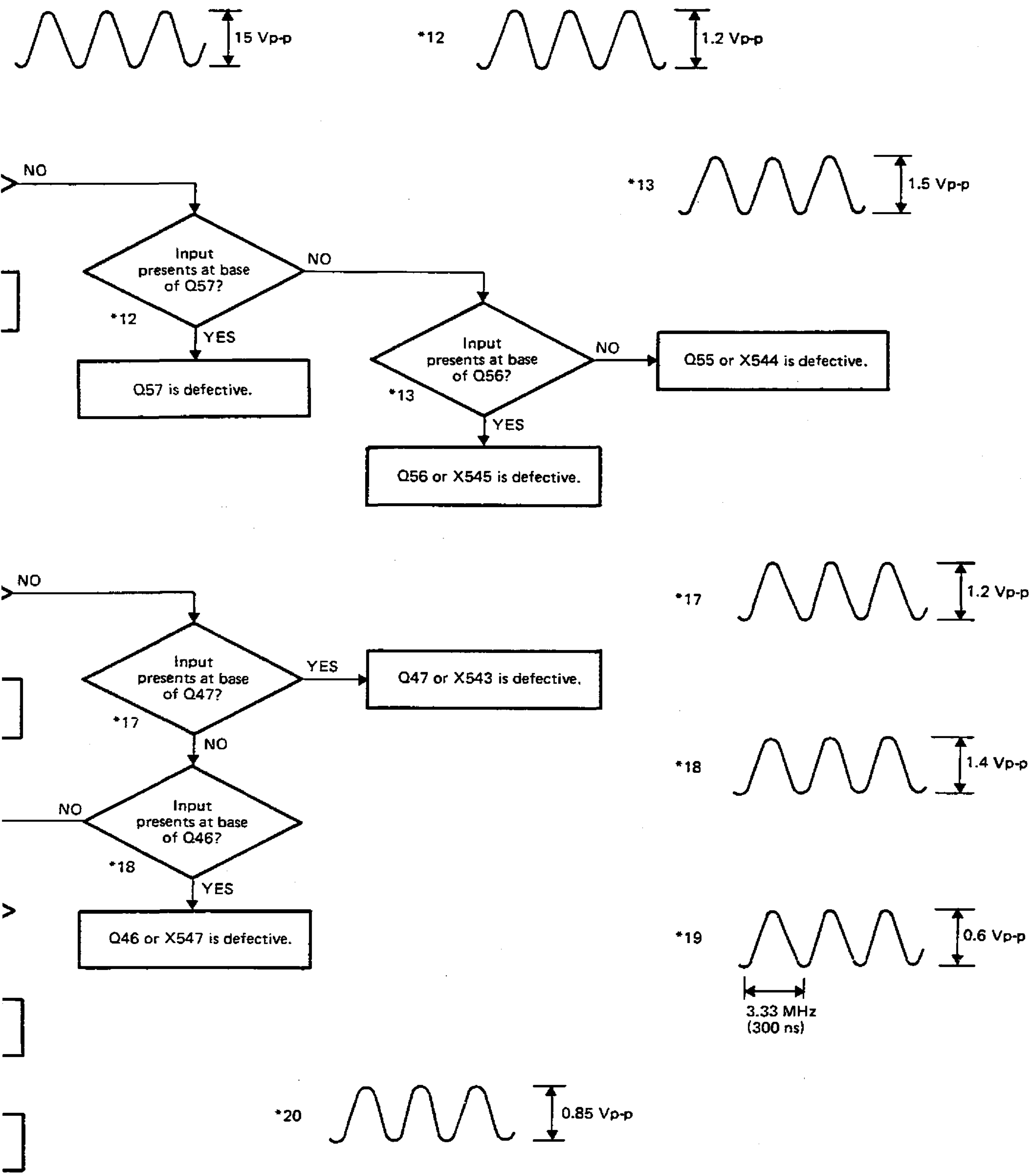

15 Vp-p
*12
1.2 Vp-p
*13
1.5 Vp-p
NO
Input presents at base of Q57?
*12
NO
YES
Q57 is defective.
Input presents at base of Q56?
*13
NO
Q55 or X544 is defective.
YES
Q56 or X545 is defective.
NO
*17
1.2 Vp-p
Input presents at base of Q47?
*17
YES
Q47 or X543 is defective.
NO
*18
1.4 Vp-p
NO
Input presents at base of Q46?
*18
YES
Q46 or X547 is defective.
*19
0.6 Vp-p
3.33 MHz
(300 ns)
*20
0.85 Vp-p

CHART 86 X-Y Recorder

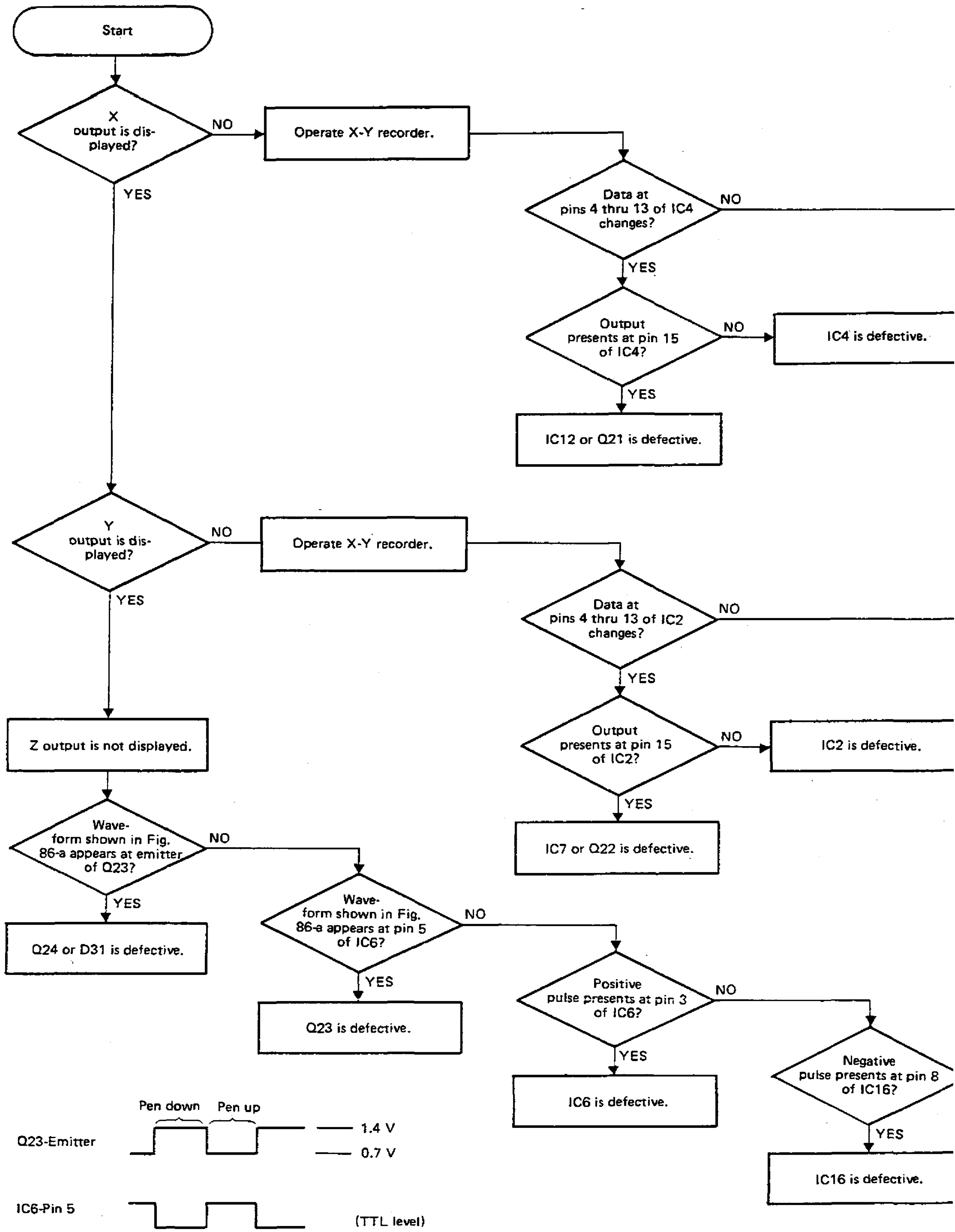


Fig. 86-a

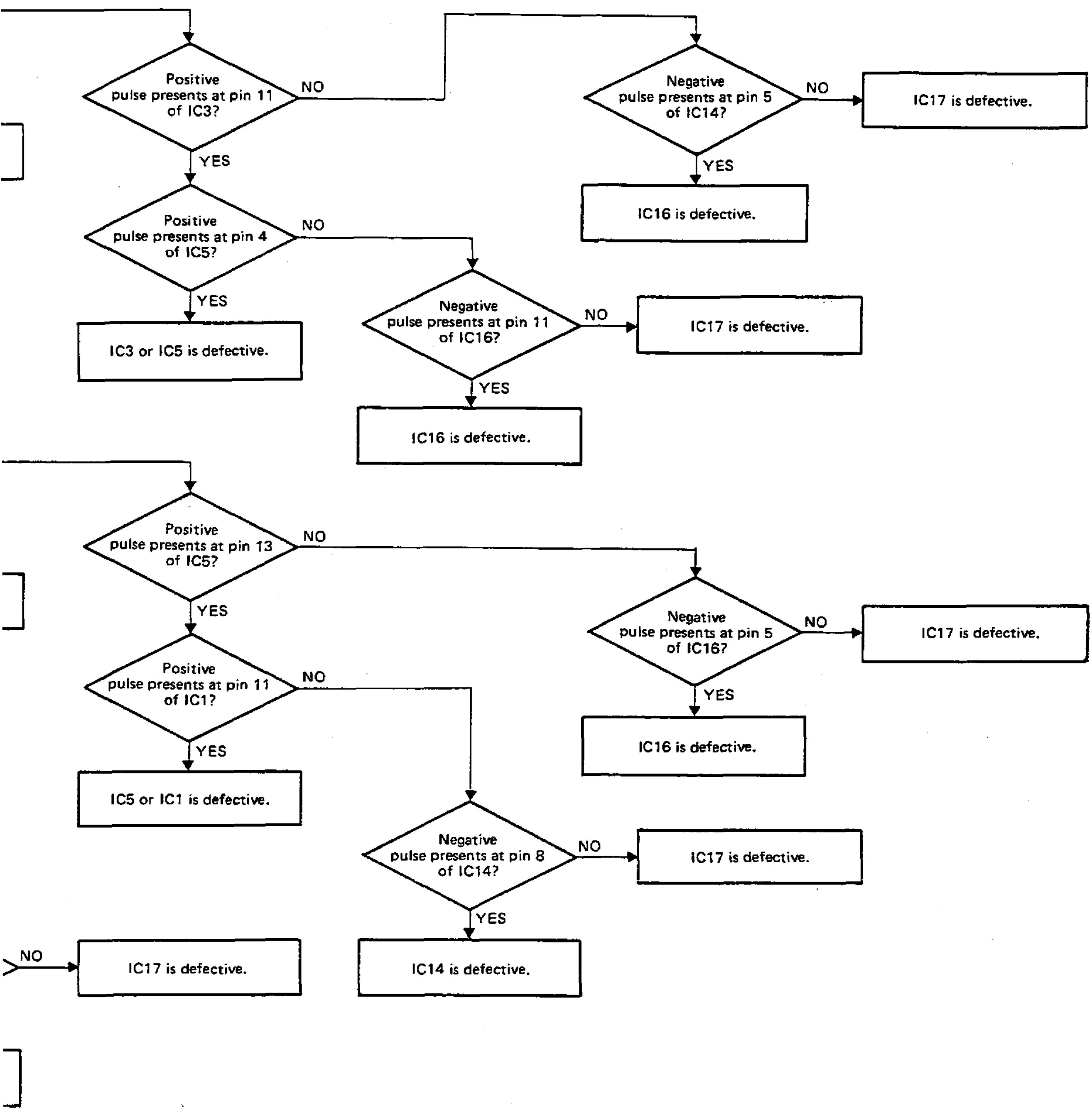

Positive pulse presents at pin 11 of IC3?
NO
YES
Positive pulse presents at pin 4 of IC5?
NO
YES
IC3 or IC5 is defective.
Negative pulse presents at pin 5 of IC14?
NO
IC17 is defective.
YES
IC16 is defective.
Negative pulse presents at pin 11 of IC16?
NO
IC17 is defective.
YES
IC16 is defective.
Positive pulse presents at pin 13 of IC5?
NO
YES
Positive pulse presents at pin 11 of IC1?
NO
YES
IC5 or IC1 is defective.
Negative pulse presents at pin 5 of IC16?
NO
IC17 is defective.
YES
IC16 is defective.
Negative pulse presents at pin 8 of IC14?
NO
IC17 is defective.
YES
IC14 is defective.
NO
IC17 is defective.

CHART 87 Option 02 Preamplifier

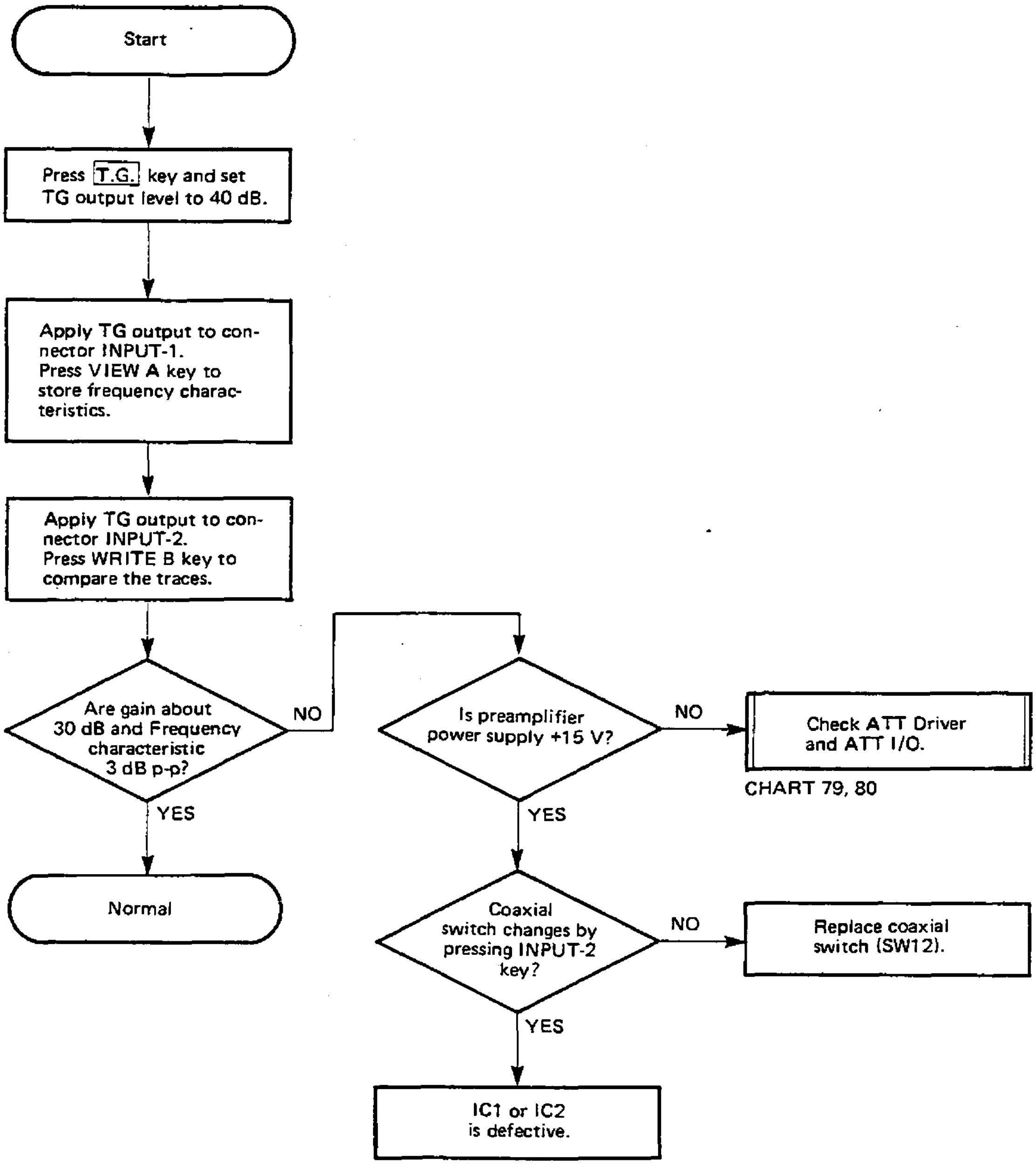
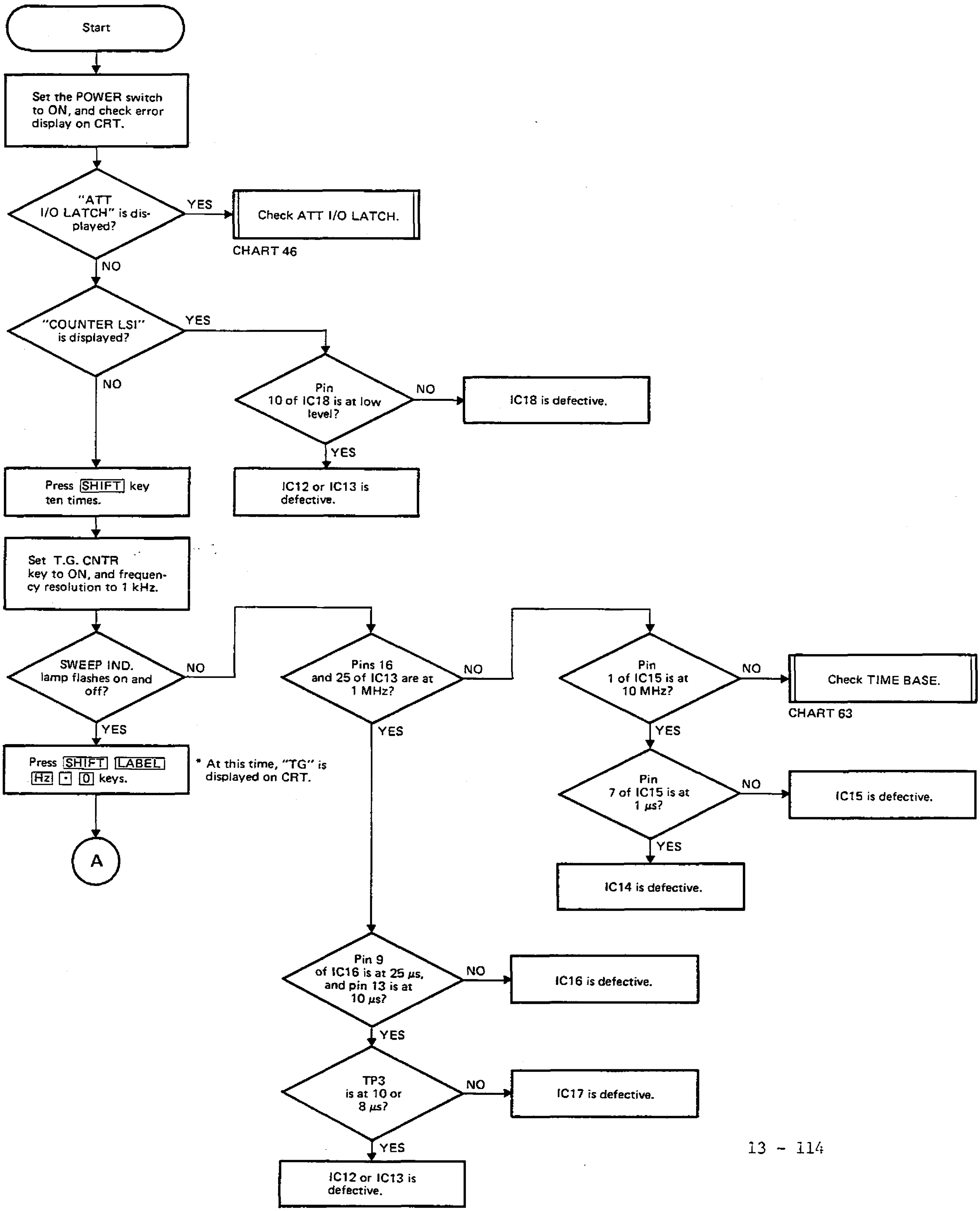
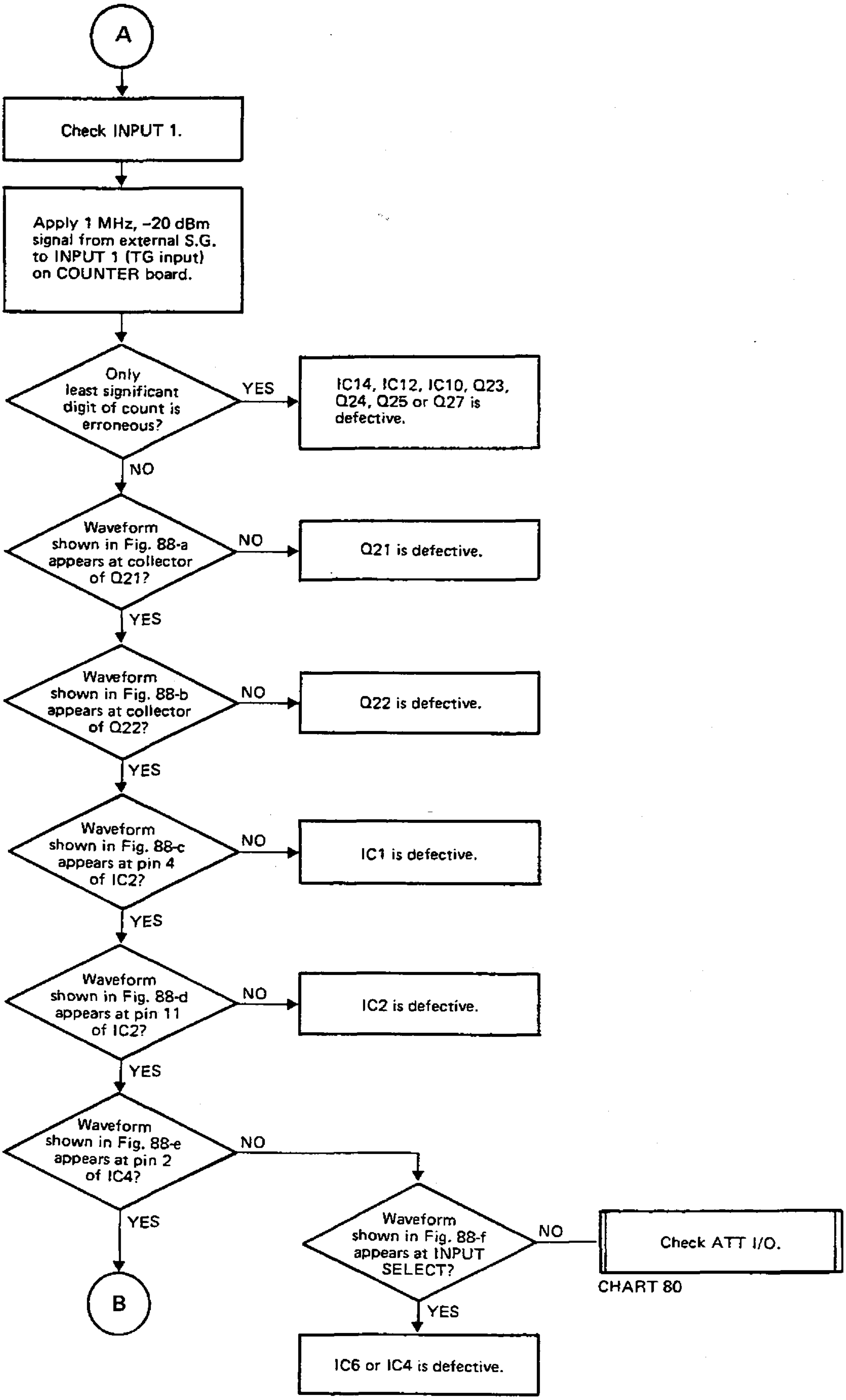


CHART 88 Counter





Q21 (Collector)

Q22 (Collector)

IC2-Pin 4

IC2-Pin 11

IC4-Pin 2

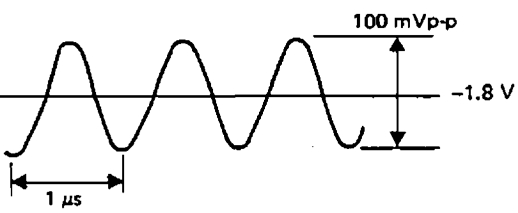


Fig. 88-a

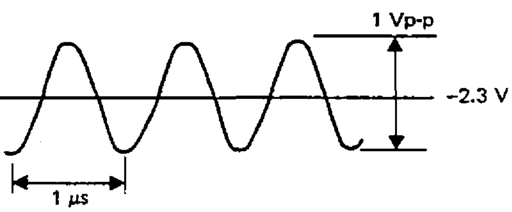


Fig. 88-b

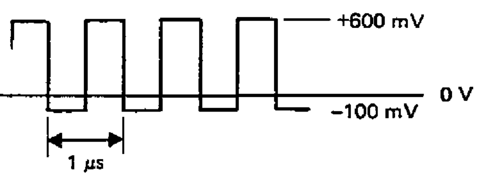


Fig. 88-c

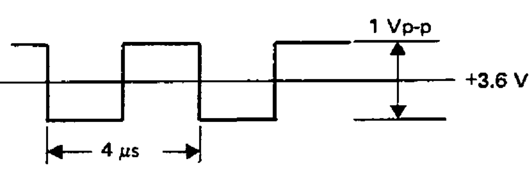


Fig. 88-d

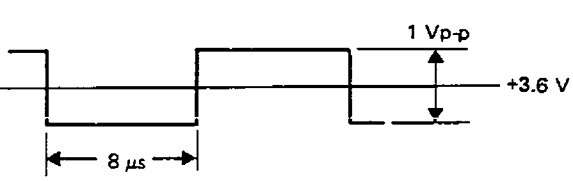
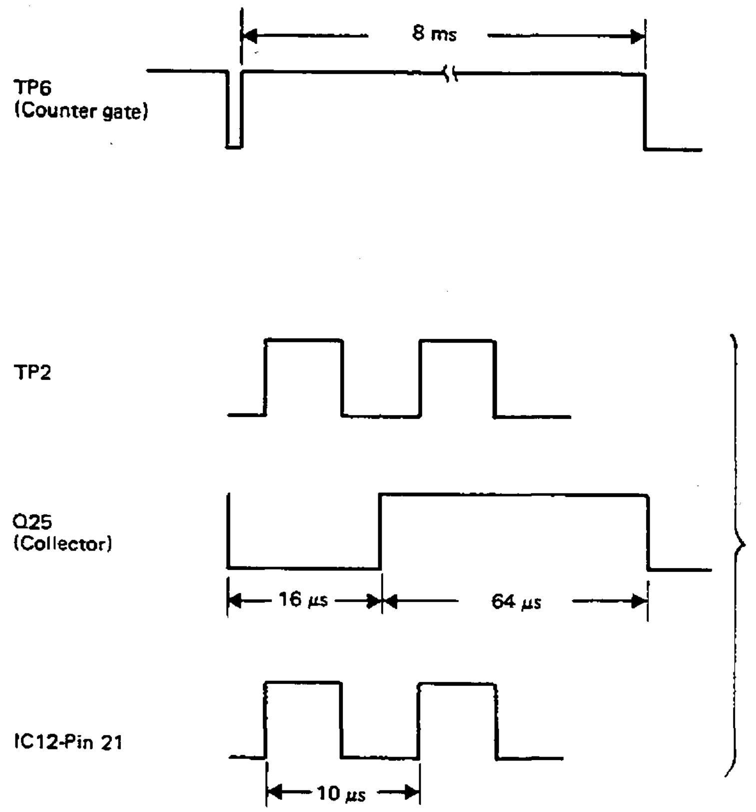
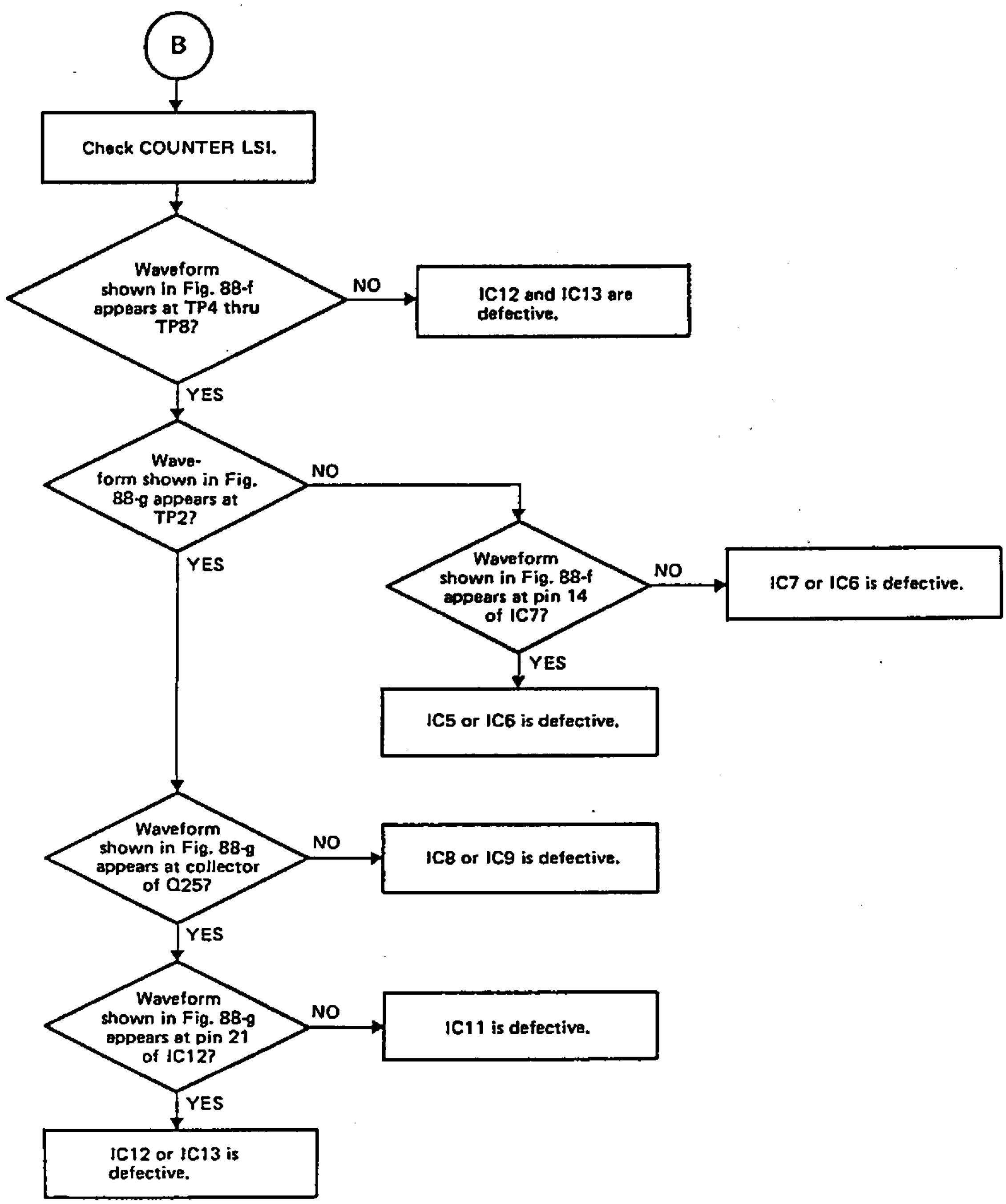


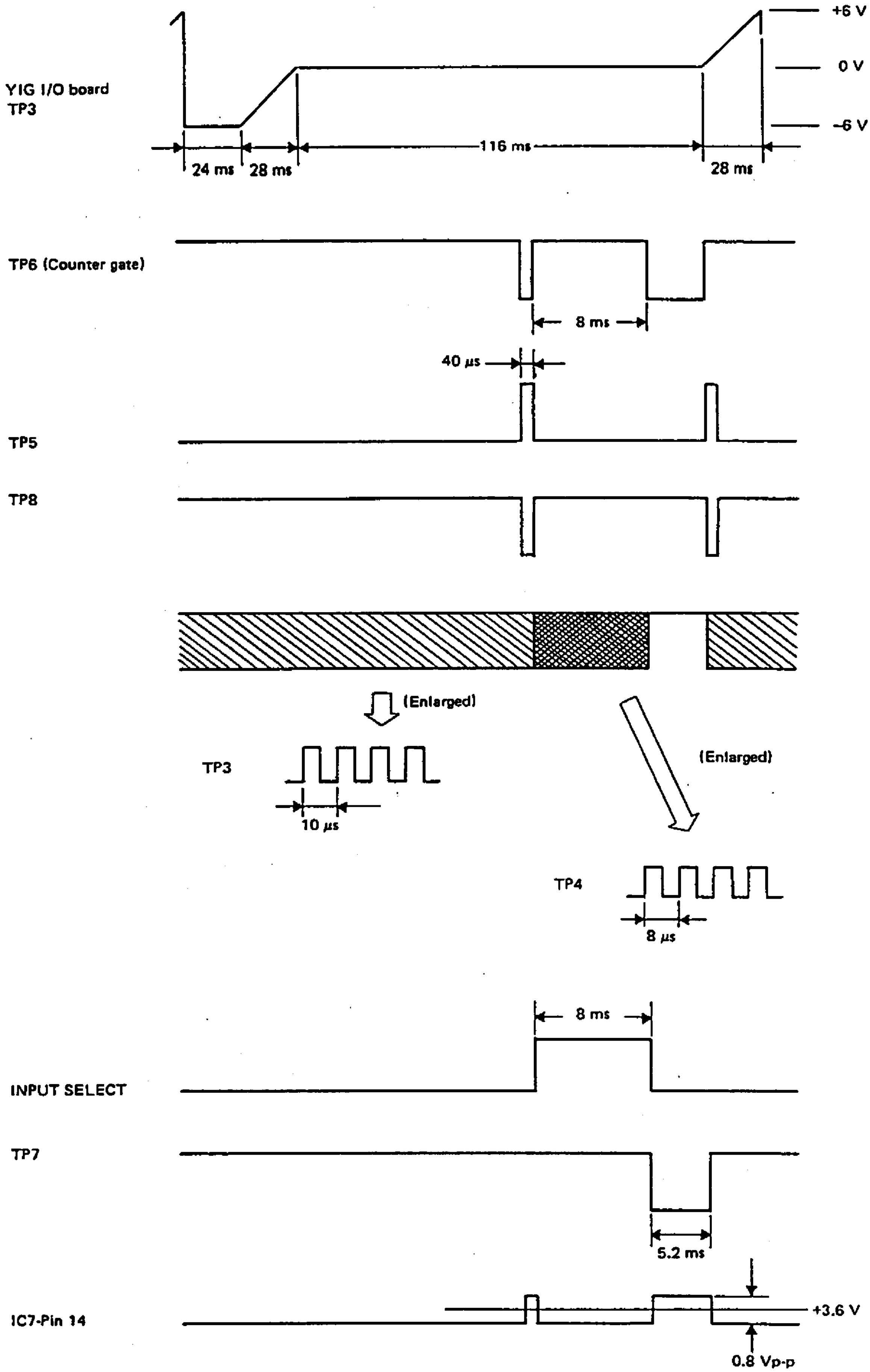
Fig. 88-e



* Waveform while gate is open (during 8 ms for TP6).

Fig. 88-g


B
Check COUNTER LSI.
Waveform shown in Fig. 88-f appears at TP4 thru TP8?
NO
IC12 and IC13 are defective.
YES
Wave-form shown in Fig. 88-g appears at TP2?
NO
Waveform shown in Fig. 88-f appears at pin 14 of IC7?
NO
IC7 or IC6 is defective.
YES
IC5 or IC6 is defective.
YES
Waveform shown in Fig. 88-g appears at collector of Q25?
NO
IC8 or IC9 is defective.
YES
Waveform shown in Fig. 88-g appears at pin 21 of IC12?
NO
IC11 is defective.
YES
IC12 or IC13 is defective.



YIG I/O board
TP3
+6 V
0 V
-6 V
24 ms
28 ms
116 ms
28 ms
TP6 (Counter gate)
8 ms
40 μs
TP5
TP8
(Enlarged)
TP3
10 μs
(Enlarged)
TP4
8 μs
8 ms
INPUT SELECT
TP7
5.2 ms
IC7-Pin 14
+3.6 V
0.8 Vp-p

Fig. 88-f

ADVANTEST CORPORATION

INSTRUCTION

MANUAL

TR4172

SPECTRUM ANALYZER
VOL-2

MANUAL NUMBER EA00 8704

Relation Manual
TR4172 VOL-1

Before reselling to other corporations or re-exporting to other countries, you are required to obtain permission from both the Japanese Government under its Export Control Act and the U.S. Government under its Export Control Law.

First printing September 1, 1982
Printed in Japan

SECTION 14
PARTS LIST, PARTS ALLOCATIONS AND CIRCUIT DIAGRAM

14-1. GENERAL

This section lists the electric parts list and mechanical parts list used in the TR4172 Spectrum analyzer and its mechanical illustrations and parts allocations and circuit diagrams. When changing parts, check the ratings and use parts having equivalent ratings.

Electrical parts lists and electrical parts allocations are followed by the circuit diagrams, then comes mechanical parts lists with mechanical parts illustrations.

NOTE

These specifications may be changed without prior notice by improvement of ADVANTEST's quality control.

14-2. SYMBOLS AND ABBREVIATIONS

Table 14-1 lists the symbols and abbreviations used in this manual, including the circuit drawings.

ABBREVIATIONS

A	ampere	dBm	decibel referred to 1mW
AC	alternating current	dBμ	decibel (0dBμ=1μVrms.)
ADJ.	adjustment	DC	direct current
A/D	analog-to-digital	DET.	detector
AMP.	amplifier	DIV.(div.)	division
ATT.	attenuator	DISP.	dispersion
ASTIG.	astigmatism		
ANT.	antenna	ELECT	electrolytic
AUTO	automatic, -operation	EXT.	external
BCD	binary coded decimal	F	farad
B.P.F.	bandpass filter	FET.	field-effect transistor
B.W.	band width	FM	frequency modulation
		FREQ.	frequency
CAR	carbon	FXD	fixed
CAL.	calibrate	FLM	film
CER	ceramic		
cm	centimeter	g	gram
COM.	common	GHz	gigahertz
CRT	cathode-ray tube	GND	ground
D/A	digital-to-analog	H	henry
dB	decibel	h	hour

Table 14-1 ABBREVIATIONS

HI	high	OPT.	option
H.P.F.	high pass filter	OSC.	oscillator
Hz	Hertz	Ω	ohm
H.POSI.	Horizontal Position	OUT.	output
H.GAIN	Horizontal Gain		
		p	peak
IC	integrated circuit	pF	picofarad
IF	intermediate frequency	PL	phase lock
INT	internal	PLO	phase lock oscillator
		PM	phase modulation
kg	kilogram	p-p	peak-to-peak
kHz	kilohertz	PPM	pulse-position-modulation
kΩ	kiloohm	PRF	pulse-repetition frequency
kV	kilovolt	ps	picosecond
		POSI.	position
LED	light-emitting diode	PNP	positive-negative-positive
LIN.	linear		
LO	low, local oscillator	Q.P.	Quasi Peak Value
LOG.	logarithm		
L.P.F.	low pass filter	REF.	reference
LEV.	level	RF	radio frequency
		rms	root-mean-square
m	meter		
mA	milliampere	SI	silicon
MAX.	maximum	s	second (time)
MΩ	megohm	S.G.	single generator
mg	milligram	SSB	single sideband
MHz	megahertz	S.W.R	standing-wave ratio
MIN.	minimum		
min.	minute (time)	T	timed (slow-blow fuse)
mm	millimeter	TTL	transistor-transistor logic
MOD.	modulator	TV	television
ms	millisecond	TP	test point
mV	millivolt		
mVrms.	millivolt rms	VAR	variable
mW	milliwatt	V	volt
μA	microampere	VA	voltampere
μF	microfarad	VCO	voltage-controlled oscillator
μH	microhenry	VFO	variable-frequency oscillator
μs	microsecond	Vp-p	volts peak-to-peak
μV	microvolt	Vrms.	volts rms
μVrms.	microvolt rms	V.S.W.R.	voltage standing wave ratio
μW	microwatt	V.POSI.	vertical position
MANU.	manual	V.GAIN	vertical gain
MIX.	mixer	W	watt
		YIG.	yttrium-iron-garnet
NPN	negative-positive-negative		
nA	nanoampere	1st	the first
NC	no connection	2nd	the second
NORM.	normal	3rd	the third
ns	nanosecond		
nW	nanowatt		

Table 14-1 ABBREVIATIONS

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1 thru IC4	SMM-2764-5	MBM2764-25Z	IC:
IC5	SIT-74LS273-9	SN74LS273N	IC: Octal D-Type Flip Flop Low Power
IC6	SIT-74LS273-9	SN74LS273N	IC: Octal D-Type Flip Flop Low Power
IC7	SIT-74LS368-9	SN74LS368N	IC: Hex Bus Driver Low Power
IC8	SIT-74LS139-9	SN74LS139N	IC: Dual 2-to-4 Line Decoder/Multiplexer Low Power
IC9	SIT-74LS245-9	SN74LS245N	IC: Octal Bus Tranceiver Low Power
IC10	SIT-74LS14-9	SN74LS14N	IC: Hex Schmitt-Trigger Inverter Low Power
IC11	SIT-74LS138-9	SN74LS138N	IC: 3-to-8 Line Decoder/Multiplexer Low Power
C21 thru C25	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C26 thru C30	CTA-AC1U50V-2	244M5002-105M	C: FXD ELECT TANTAL 1uF +20% 50V
C31	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10uF ±20% 16V
C32	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10uF ±20% 16V
L41	LCL-T00084-1	LT-3	L: FXD Coil

TR4172
LOG BLOCK
MEP-337

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
J1 thru J3	JCF-AC00LJX02-2	UM-QR	Connector

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
Q1	STN-2SC2150-1	2SC2150	Transistor SI NPN
D11	SDS-1SS97-1	1SS97	Diode SI
D12	SDS-1SS97-1	1SS97	Diode SI
R21	RCB-AH1R5K-1	RD25S 1.5KΩJ	R: FXD CAR 1.5kΩ ±5% 1/4W
R22	RCB-AH5R6K-1	RD25S 5.6kΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R23	RCB-AH5R6K-1	RD25S 5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R25	RCP-AB15-3	MCR18-15ΩJ	R: FXD CHIP 15Ω
C32	CCP-AT1PR1K-2	UC122A0010C	C: FXD CHIP 1pF
C33	CCP-ADR01U50V-1	C3225Y5V1H103Z	C: FXD CHIP 0.01μF +80, -20% 50V
C34	CCP-ADR01U50V-1	C3225Y5V1H103Z	C: FXD CHIP 0.01μF +80, -20% 50V
C35	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF ±20% 50V
C36	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF ±20% 50V
C37	CSM-AGR1U50V-1	FD22Y5V1H104Z	C: FXD CER 0.1μF +80, -20% 50V
C38	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF ±20% 50V
C39 thru C41	CCP-AT2PR1K-2	UC122A0020C	C: FXD CHIP 2pF
C42	CCP-AT5PR1K-2	UC122A0050C	C: FXD CHIP 5pF
L51	LCL-C00012-1	CSL0609-471K	L: FXD Coil
L52	LCL-A00507-1	*	L: FXD Coil
L53	LCL-A00507-1	*	L: FXD Coil

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
U11	SIA-TL082	TL082CP	IC: Dual Operational Amplifier
Q16 thru Q18	STN-2SC1426-1	2SC1426	Transistor SI NPN
Q19	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q20	STN-2SC1426-1	2SC1426	Transistor SI NPN
Q21	STN-2SC1730-1	2SC1730	Transistor SI NPN
Q22 thru Q24	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
D31	SDS-1SV35-1	1SV35	Pin Diode
D32 thru D35	SDS-1S953-1	1S953	Diode SI
R41	RCB-AH51	RD25S 51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R42	RCB-AH8R2K	RD25S 8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R43	RCB-AH4R7K	RD25S 4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R44	RCB-AH560	RD25S 560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R45	RCB-AH560	RD25S 560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R46	RCB-AH270	RD25S 270ΩJ	R: FXD CAR 270Ω ±5% 1/4W
R47	RCB-AH68	RD25S 68ΩJ	R: FXD CAR 68Ω ±5% 1/4W
R48	RCB-AH390	RD25S 390ΩJ	R: FXD CAR 390Ω ±5% 1/4W
R49	RCB-AH330K	RD25S 330KΩJ	R: FXD CAR 330kΩ ±5% 1/4W
R50	RCB-AH15K	RD25S 15KΩJ	R: FXD CAR 15kΩ ±5% 1/4W
R51	RCB-AH10K	RD25S 10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R52	RCB-AH15K	RD25S 15KΩJ	R: FXD CAR 15kΩ ±5% 1/4W
R53	RVR-BE5K	X6T(2)5KΩ	R: VAR WW 5kΩ
R54	RCB-AH33K	RD25S 33KΩJ	R: FXD CAR 33kΩ ±5% 1/4W
R55	RCB-AH10K	RD25S 10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R56	RCB-AH1K	RD25S 1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R57	RCB-AH22K	RD25S 22KΩJ	R: FXD CAR 22kΩ ±5% 1/4W
R58	RCB-AH10K	RD25S 10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R59	RCB-AH12K	RD25S 12KΩJ	R: FXD CAR 12kΩ ±5% 1/4W
R60	RCB-AH4R7K	RD25S 4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R61	RCB-AH1R5K	RD25S 1.5KΩJ	R: FXD CAR 1.5kΩ ±5% 1/4W
R62	RCB-AH18K	RD25S 18KΩJ	R: FXD CAR 18kΩ ±5% 1/4W
R63	RCB-AH2R2K	RD25S 2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R64	RCB-AH22K	RD25S 22KΩJ	R: FXD CAR 22kΩ ±5% 1/4W
R65	RCB-AH2R7K	RD25S 2.7KΩJ	R: FXD CAR 2.7kΩ ±5% 1/4W
R66	RCB-AH18K	RD25S 18KΩJ	R: FXD CAR 18kΩ ±5% 1/4W
R67	RCB-AH51	RD25S 51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R68	RCB-AH3R9K	RD25S 3.9KΩJ	R: FXD CAR 3.9kΩ ±5% 1/4W
R69	RCB-AH3R9K	RD25S 3.9KΩJ	R: FXD CAR 3.9kΩ ±5% 1/4W
R70	RCB-AH51	RD25S 51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R71	RCB-AH270	RD25S 270ΩJ	R: FXD CAR 270Ω ±5% 1/4W
R72	RCB-AH10	RD25S 10ΩJ	R: FXD CAR 10Ω ±5% 1/4W
R73	DSP-000014-1	14D46	R: Thermistor
R74	DSP-000014-1	14D46	R: Thermistor
R75	RCB-AH10K	RD25S 10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R76	RCB-AH1R8K	RD25S 1.8KΩJ	R: FXD CAR 1.8kΩ ±5% 1/4W
R77	RCB-AH10K	RD25S 10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R78	RCB-AH8R2K	RD25S 8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R79	RCB-AH220	RD25S 220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R80	RCB-AH4R7K	RD25S 4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R81	RCB-AH22	RD25S 22ΩJ	R: FXD CAR 22Ω ±5% 1/4W
R82	RCB-AH330	RD25S 330ΩJ	R: FXD CAR 330Ω ±5% 1/4W
R83	RCB-AH4R7K	RD25S 4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R84	RCB-AH6R8K	RD25S 6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R85	RCB-AH680	RD25S 680ΩJ	R: FXD CAR 680Ω ±5% 1/4W
R86	RCB-AH390	RD25S 390ΩJ	R: FXD CAR 390Ω ±5% 1/4W
R87	RCB-AH100	RD25S 100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R88	RCB-AH51	RD25S 51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R89	RCB-AH4R7K	RD25S 4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R90	RCB-AH8R2K	RD25S 8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R91	RCB-AH1K	RD25S 1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R92	RCB-AH470	RD25S 470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R93	RCB-AH51	RD25S 51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R94	RCB-AH4R7K	RD25S 4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R95	RCB-AH8R2K	RD25S 8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R96	RCB-AH1K	RD25S 1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R97	RCB-AH470	RD25S 470Ω	R: FXD CAR 470Ω ±5% 1/4W
R98	RCB-AH220	RD25S 220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R99	RCB-AH100	RD25S 100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R100	RCB-AH150	RD25S 150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R101	RCB-AH100	RD25S 100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R102	RCB-AH68	RD25S 68ΩJ	R: FXD CAR 68Ω ±5% 1/4W
C111	CMC-AB120PR3K-4	DM10D121J3	C: FXD ELECT TANTAL 120pF ±5% 300V
C112	CSM-ACR01U50V-1	0.01UF 50WV	C: FXD CER 0.01µF +80, -20% 50V
C113	CSM-AC10P50V-1	10PF 50WV	C: FXD CER 10pF ±10% 50V
C114	CSM-ACR01U50V-1	0.01UF 50WV	C: FXD CER 0.01µF +80, -20% 50V
C115	CSM-ACR01U50V-1	0.01UF 50WV	C: FXD CER 0.01µF +80, -20% 50V
C116	CSM-AC10P50V-1	10PF 50WV	C: FXD CER 10pF ±10% 50V
C117 thru C119	CSM-ACR01U50V-1	0.01UF 50WV	C: FXD CER 0.01µF +80, -20% 50V
C120	CMC-AB15PR5K-6	DM10C150K5	C: FXD DIPPED MICA 15pF ±10% 500V
C121	CTM-AC10P-1	ECV1ZW10X32	C: VAR CER 10pF
C122	CMC-AB1PR5K-2	DM10C010D5	C: FXD DIPPED MICA 1pF ±0.5% 500V
C123	CMC-AB3PR5K-2	DM10C030D5	C: FXD DIPPED MICA 3pF ±0.5% 500V
C124	CMC-AB15PR5K-6	DM10C 150K5	C: FXD DIPPED MICA 15pF ±10% 500V
C125	CTM-AC10P-1	ECV1ZW10X32	C: VAR CER 10pF
C126	CMC-AB3PR5K-2	DM10C030D5	C: FXD DIPPED MICA 3pF ±0.5% 500V
C127	CMC-AB15PR5K-6	DM10C150K5	C: FXD DIPPED MICA 15pF ±10% 500V
C128	CTM-AC10P-1	ECV1ZW10X32	C: VAR CER 10pF
C129	CMC-AB1PR5K-2	DM10C010D5	C: FXD DIPPED MICA 1pF ±0.5% 500V
C130	CMC-AB3PR5K-2	DM10C030D5	C: FXD DIPPED MICA 3pF ±0.5% 500V
C131	CMC-AB15PR5K-6	DM10C150K5	C: FXD DIPPED MICA 15pF ±10% 500V

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Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C132	CTM-AC10P-1	ECV1ZW10X32	C: VAR CER 10pF
C133 thru C136	CSM-ACR01U50V-1	0.01UF 50WV	C: FXD CER 0.01μF +80, -20% 50V
C137	CMC-AB27PR5K-4	DM10D270J5	C: FXD DIPPED MCIA 27pF ±5% 500V
C138	CMC-AB220P3K-4	DM10D221J3	C: FXD DIPPED MICA 220pF ±5% 300V
C139	CSM-ACR01U50V-1	0.01UF 50WV	C: FXD CER 0.01μF +80, -20% 50V
C140	CMC-AB82PR3K-4	DM10D820J3	C: FXD DIPPED MICA 82pF ±5% 300V
C141 thru C146	CSM-ACR01U50V-1	0.01UF 50WV	C: FXD CER 0.01μF +80, -20% 50V
C147	CMC-AB82PR3K-4	DM10D820J3	C: FXD DIPPED MICA 82pF ±5% 300V
C148	CSM-AGR1U50V-1	FD22Y5V1H104Z	C: FXD CER 0.1μF +80, -20% 50V
C149	CSM-ACR01U50V-1	0.01UF 50WV	C: FXD CER 0.01μF +80, -20% 50V
C150	CMC-AB82PR3K-4	DM10D820J3	C: FXD DIPPED MICA 82pF ±5% 300V
C151 thru C153	CSM-ACR01U50V-1	0.01UF 50WV	C: FXD CER 0.01μF +80, -20% 50V
C154	CMC-AB82PR3K-4	DM10D820J3	C: FXD DIPPED MIA 82pF ±5% 300V
C155	CSM-ACR01U50V-1	0.01UF 50WV	C: FXD CER 0.01μF +80, -20% 50V
C156	CSM-ACR01U50V-1	0.01UF 50WV	C: FXD CER 0.01μF +80, -20% 50V
C157	CSM-AC680P50V-1	68PF 50WV	C: FXD CER 68pF ±10% 50V
C158	CSM-ACR047U50V-1	0.047UF 50WV	C: FXD CER 0.047μF +80, -20% 50V
C159	CSM-AC10P50V-1	10PF 50WV	C: FXD CER 10pF ±10% 50V
C160 thru C162	CSM-ACR047U50V-1	0.047UF 50WV	C: FXD CER 0.047μF +80, -20% 50V
C163	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10μF 25V
C164	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10μF 25V
C165	CSM-ACR01U50V-1	0.01UF 50WV	C: FXD CER 0.01μF +80, -20% 50V
C166	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10μF 25V
C167	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10μF 25V
C168	CSM-ACR01U50V-1	0.01UF 50WV	C: FXD CER 0.01μF +80, -20% 50V
C169	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10μF 25V
C170	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10μF 25V
L176	LCL-A00065-1	LS23	L: FXD Coil
L177	LCL-A00066-1	LS24	L: FXD Coil
L178	LCL-B00376-1	TPF0410-331K	L: FXD Coil
L179	LCL-E00388-1	*	L: FXD Coil
L180	LCL-C00584-1	*	L: FXD Coil
L181	LCL-A00064-1	LS22	L: FXD Coil
L182 thru L184	LCL-C00584	*	L: FXD Coil
L185	LCL-A00065-1	LS23	L: FXD Coil
L186	LCL-B00363-1	TPF0410-1R5K	L: FXD Coil
L187	LCL-B00363-1	TPF0410-1R5K	L: FXD Coil
L188			Not assigned
L189	LCL-C00329-1	L07C29	L: FXD Coil
L190	LCL-E00389-1	*	L: FXD Coil

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
L191	LCL-E00388-1	*	L: FXD Coil
L192 thru L194	LCL-C00329-1	L07C29	L: FXD Coil
L195 thru L197	LCL-C00010-1	CSL0609-181K	L: FXD Coil
MIX201	DEE-000736	*	Mixer
X206	DNP-000140-1	XU-029	Crystal
JP1 thru JP3	JCP-AA003PX05-1	A-1103 (NS)	Connector

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Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
D1	SEE-SF10DH1-1	SF10DH1	Thyristor
D2	SEE-SF10DH1-1	SF10DH1	Thyristor
R1	RVR-BL2K-1	RV16YN15SB2KΩ	R: VAR CERMET 2kΩ
R2	RVR-BA2K-1	X13B2KΩ	R: VAR WW 2kΩ
R3	RVR-BA5K-1	X13B5KΩ	R: VAR WW 5kΩ
R4	RVR-BL5K-1	RV16YN15SB5KΩ	R: VAR CERMET 5kΩ
L1	LCL-E00474-1	*	L: FXD Coil
B1	DMF-000488-1	S4302	Fan Motor
J1	JCD-AA003PX01-1	6J4	Connector
J2	JCS-AE004JX02-1	DBM-9W4S	Connector
J3	JCP-AX002JX01-1	SI-7502	Connector
J4	JCB-AC044JX01-1	CR7E-44DA-3.96E	Connector
J5	DCB-QS0495-1	TOC-1A12060N	Connector
J6	DCB-QS0483-1	TOC-1A03060N	Connector
J7	DCB-QS0488-1	TOC-1A06030N	Connector
J8 thru J11	JCF-AB001JX02-1	BNC-071	Connector
CBL1	DCB-SS0966X01-1	*	Cable
CBL2		*	Cable
CBL3	DCB-FF0981X01-1	*	Cable
CBL4	DCB-FF0985X01-1	*	Cable
CBL5	DCB-FF0985X05-1	*	Cable
CBL6	DCB-FF0985X01-1	*	Cable
	JCF-AC001PX01-2	UM-QLP-1.5	Connector
	JTM-AF001JX01-1	DM53742-5001	Connector
P1	JTE-AG001EX01-1	FT-44-155	Terminal
P2	JCP-AX002JX01-1	SI-7502	Terminal
P3 thru P9	JTE-AY001JX01-1	75187-003	Terminal, (J1)
T1	LTP-000486-1	*	Power Transformer
F1	DFT-AF2R5A-1	MDA-2.5A	Fuse
CRT-1	NCR-000169-1	*	CRT

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R1 thru R5	RWR-AER3QK-1	M2-0.3ΩK	R: FXD SOLID 0.3Ω
R6	RCB-AH6R8-1	RD25S6.8ΩJ	R: FXD CAR 6.8Ω ±5% 1/4W
R7 thru R11	RCB-AH100K-1	RD25S100KΩJ	R: FXD CAR 100kΩ ±5% 1/4W
C21	CCK-ASR022F16V-1	SM16VRSN22000	C: FXD ELECT 0.022uF 16V
C22	CCK-ASR022F16V-1	SM16VRSN22000	C: FXD ELECT 0.022uF 16V
C23 thru C25	CCK-AS4700U50V-1	SM50VRSN4700	C: FXD ELECT 4700uF 50V
C26	CCK-AS100U350V-1	SM350VRSN100	C: FXD ELECT 100uF 350V
C27 thru C30	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1uF +80, -20% 50V
C31	CSM-ACR01UR5K-1	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
J41 thru J57	JCB-AC056JX02-2	CR7E-56DB-3.96DS	Connector
J58 thru J61	JCB-AC044JX02-2	CR7E-44DB-3.96DS	Connector
J62	JCB-AC036JX02-2	CR7E-36DB-3.96DS	Connector
J63	JCP-AA012PX01-1	A-1112	Connector
J64	JCP-AA006PX01-1	A-1106	Connector
J65	JCF-AC001JX01-1	UM-LR-PC	Connector
J66	JCF-AC001JX01-1	UM-LR-PC	Connector
J67			Not assigned
CBL71	DCB-RR0923X01-1	*	Cable
CBL72	DCB-RR0923X01-1	*	Cable
CBL73	DCB-RR0924X01A-1	*	Cable
CBL74	DCB-RS0921X01A-1	*	Cable

TR4172
DISPLAY POWER 1
BGC-010198

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1	SIA-301A-1	LM301A	IC: Operational Amplifier
IC2	SIA-311-1	LM311H	IC: Voltage Comparator
IC3	SIT-74LS123	SN74LS123N	IC: Dual Retriggerable Monostable Multivibrator with Clear Low Power
IC4	SIA-301A-1	LM301A	IC: Operational Amplifier
IC5	SDZ-6-1	LM399H	IC: Precision Reference
IC6	SIA-301A-1	LM301A	IC: Operational Amplifier
IC7	SDZ-6-1	LM399H	IC: Precision Reference
IC8	SIA-723H-1	LM723CH	IC: Voltage Regulator
IC9	SIA-301A-1	LM301A	IC: Operational Amplifier
Q11 thru Q13	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q14	STN-2SC510-1	2SC510	Transistor SI NPN
Q15	STN-2SC1279-1	2SC1279S	Transistor SI NPN
Q16	STN-2SC1279-1	2SC1279S	Transistor SI NPN
Q17	STN-2SD330-1	2SD330	Transistor SI NPN
D21	SDZ-1N983-4	RD-82E	Zener Diode
D22	SDS-1S953-1	1S953	Diode SI
D23	SDS-1S953-1	1S953	Diode SI
D24	SDZ-W061-1	WZ-061	Zener Diode
D25	SDZ-W061-1	WZ-061	Zener Diode
D26 thru D28	SDS-1S953-1	1S953	Diode SI
R31	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R32	RMF-AR2R2KFK-1	SN14K2E2.2KΩF	R: FXD Metal FLM 2.2kΩ ±1% 1/4W
R33	RVR-BD500	X6S500Ω	R: VAR WW 500Ω
R34	RMF-AR2R2KFK-1	SN14K2E2.2KΩF	R: FXD Metal FLM 2.2kΩ ±1% 1/4W
R35	RMF-AR9R1KFK-1	SN14K2E9.1KΩF	R: FXD Metal FLM 9.1kΩ ±1% 1/4W
R36	RMF-AR1R8KFK-1	SN14K2E1.8KΩF	R: FXD Metal FLM 1.8kΩ ±1% 1/4W
R37	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R38	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R39	RCB-AH2R2K-1	SN14K2E2.2KΩF	R: FXD Metal FLM 2.2kΩ ±1% 1/4W
R40	RCB-AH4R7K-1	SN14K2E4.7KΩF	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R41	RCB-AH390K-1	RD25S390KΩJ	R: FXD CAR 390kΩ ±5% 1/4W
R42	RCB-AH15K-1	RD25S15KΩJ	R: FXD CAR 15kΩ ±5% 1/4W
R43	RMF-AR8R2KFK-1	SN14K2E8.2KΩF	R: FXD Metal FLM 8.2kΩ ±1% 1/4W
R44	RVR-BD1K-1	X6S1kΩ	R: VAR WW 1kΩ
R45	RMF-AR6R8KFK-1	SN14K2E6.8KΩF	R: FXD Metal FLM 6.8kΩ ±1% 1/4W
R46	RMF-AR3R9KFK-1	SN14K2E3.9KΩF	R: FXD Metal FLM 3.9kΩ ±1% 1/4W
R47	RMF-AR7R5KFK-1	SN14K2E7.5KΩF	R: FXD Metal FLM 7.5kΩ ±1% 1/4W
R48	RCB-AH15K-1	RD25S15KΩJ	R: FXD CAR 15kΩ ±5% 1/4W
R49	RMF-AR6R2KFK-1	SN14K2E6.2KΩF	R: FXD Metal FLM 6.2kΩ ±1% 1/4W
R50	RVR-BD1K-1	X6S1KΩ	R: VAR WW 1kΩ
R51	RMF-AR18KFK-1	SN14K2E18KΩF	R: FXD Metal FLM 18kΩ ±1% 1/4W
R52	RMF-AR4R7KFK-1	SN14K2E4.7KΩF	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R53	RMF-AR7R5KFK-1	SN14K2E7.5KΩF	R: FXD Metal FLM 7.5kΩ ±1% 1/4W
R54	RCB-AH27K-1	RD25S27KΩJ	R: FXD CAR 27kΩ ±5% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R55	RMF-AR5R1K-1	SN14K2E5.1KΩF	R: FXD Metal FLM 5.1kΩ ±1% 1/4W
R56	RCB-AH10-1	RD25S10ΩJ	R: FXD CAR 10Ω ±5% 1/4W
R57	RMF-AR18KFK-1	SN14K2E18KΩF	R: FXD Metal FLM 18kΩ ±1% 1/4W
R58	RVR-BD1K-1	X6S1KΩ	R: VAR WW 1kΩ
R59	RMF-AR6R8KFK-1	SN14K2E6.8KΩF	R: FXD Metal FLM 6.8kΩ ±1% 1/4W
R60	RMF-AR4R7KFK-1	SN14K2E4.7KΩF	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R61	RMF-AR7R5KFK-1	SN14K2E7.5KΩF	R: FXD Metal FLM 7.5kΩ ±1% 1/4W
R62	RMF-AR82KFK-1	SN14K2E82KΩF	R: FXD Metal FLM 82kΩ ±1% 1/4W
R63	RVR-BD500-1	X6S500Ω	R: VAR WW 500Ω
R64	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R65			Not assigned
R66	RMF-AR3R9KFK-1	SN14K2E3.9KΩF	R: FXD Metal FLM 3.9kΩ ±1% 1/4W
R67	RCB-AF18-1	RD1S18ΩJ	R: FXD CAR 18Ω ±5% 1W
R68	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R69	RCB-AH6R8K-1	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R70	RCB-AH22-1	RD25S22ΩJ	R: FXD CAR 22Ω ±5% 1/4W
C81	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C82	CSM-AC100P50V-1	100PF50WV	C: FXD CER 100pF ±10% 50V
C83	CTA-AB22U35V-1	221M3502-226M	C: FXD ELECT TANTAL 22μF ±20% 35V
C84	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C85	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10μF ±20% 16V
C86	CFM-ABR1U50V-1	501N5002-104K	C: FXD Silvered MICA 0.1μF ±10% 50V
C87	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C88	CSM-AC100P50V-1	100PF50WV	C: FXD CER 100pF ±10% 50V
C89	CTA-AB22U35V-1	221M3502-226M	C: FXD ELECT TANTAL 22μF ±20% 35V
C90	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C91	CSM-AC100P50V-1	100PF50WV	C: FXD CER 100pF ±10% 50V
C92	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C93	CTA-AB22U35V-1	221M3502-226M	C: FXD ELECT TANTAL 22μF ±20% 35V
C94	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C95	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C96	CSM-AC100P50V-1	100PF50WV	C: FXD CER 100pF ±10% 50V
C97	CTA-AB22U35V-1	221M3502-226M	C: FXD ELECT TANTAL 22μF ±20% 35V
C98	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C99	CTA-AB22U35V-1	221M3502-226M	C: FXD ELECT TANTAL 22μF ±20% 35V
C100	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C101	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C102	CSM-AC4700P5K-1	0.0047UF50WV	C: FXD CER 0.0047μF +80, -20% 50V
J111	JCP-AA003PX06-1	A-1303	Connector
J112	DCB-QS0481-1	TOC-1A03030N	Connector
BT121	DBP-000470-1	GB150-3FA2	Battery

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TR4172
DISPLAY POWER 2
BGB-010199

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
D1	SDP-S10SC4-1	S10SC4	Diode SI
D2	SDS-1S954-1	1S954	Diode SI
D3	SDS-1S954-1	1S954	Diode SI
D4 thru D6	SDS-RB402-2	S4VB10	Diode SI
D7	SDP-W02-2	W04	Diode SI
D8	SDP-W02-2	W04	Diode SI
R11	RCB-AH100K-1	RD25S100KΩJ	R: FXD CAR 100kΩ ±5% 1/4W
C21	CCK-AR470U50V-1	SM50VB470	C: FXD ELECT 470μF 50V
C22	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
Q1	STN-2N3585-1	2N3585	Transistor SI PNP
Q2	STN-2SC1830-1	2SC1830	Transistor SI NPN
Q3	STN-2SD617-1	2SD617	Transistor SI NPN
Q4	STN-2SD617-1	2SD617	Transistor SI NPN
Q5	STN-2SC1279-1	2SC1279S	Transistor SI NPN
R11	RCB-AK68K-1	RD50S68KΩJ	R: FXD CAR 68kΩ ±5% 1/2W
C21	CSM-ACR01U5K-1	0.01UF500WV	C: FXD CER 0.01μF +80, -20% 500V
C22 thru C24	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
F31	DFT-AAR1A-1	EAWK0.1A	Fuse
F32	DFN-AA1A-3	TMF51NR1(250)	Fuse
F33	DFN-AA5A-3	TMF51NR5	Fuse
F34	DFT-AAR1A-1	EAWK0.1A	Fuse
F35	DFN-AA2A-3	TMF51NR2(250)	Fuse
F36	DFN-AA2A-3	TMF51NR2(250)	Fuse
FH41 thru FH46	DFH-000625-1	FA211B	Fuse Holder
FH47 thru FH52			Not assigned
S55	DST-000593-1	5003-K-75°	Thermostat

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TR4172
DISPLAY POWER 4
BLB-010202

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
D1	SDP-W02-2	W02	Diode SI
R11 thru R16	RCB-AF100K-1	RD1S100KΩJ	R: FXD CAR 100kΩ $\pm$5% 1W
C21	CCK-AA10U350V-1	350T10	C: FXD ELECT 10μF 350V
S31	KSP-000035-1	MPS-17	Switch

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
Q1	STN-2SC2335-1	2SC2335	Transistor SI NPN
Q2	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q3	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q4	STP-2SA1015-1	2SA1015	Transistor SI PNP
Q5			Not assigned
D11 thru D15	SDS-1S953-1	1S953	Diode SI
D16 thru D19	SDP-RU2-1	RU2	Diode SI
D20	SDZ-1N989-6	EQB01-150	Zener Diode
D21 thru D25	SDP-RU2-1	RU2	Diode SI
D26	SDZ-1N989-6	EQB01-150	Zener Diode
D27	SDZ-1N989-6	EQB01-150	Zener Diode
R31	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R32	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R33	RCB-AH56K-1	RD25S56KΩJ	R: FXD CAR 56kΩ ±5% 1/4W
R34	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R35	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R36	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R37	RMF-AR680KFK-1	SN14K2E680KΩF	R: FXD Metal FLM 680kΩ ±1% 1/4W
R38	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R39	RMF-AX4R7MJM-1	RH1HVS4.7MΩJ	R: FXD Metal FLM 4.7MΩ ±5% 1W
R40	RMF-AY27MJM-1	RH2HVS27MΩJ	R: FXD Metal FLM 27MΩ ±5% 2W
R41	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R42	RCB-AC22M-1	HM1/4 22MΩJ	R: FXD CAR 22MΩ ±5% 1/4W
R43	RCB-AK1M-1	RD50S1MΩJ	R: FXD CAR 1MΩ ±5% 1/2W
R44	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R45	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R46	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R47	RCB-AH150K-1	RD25S150KΩJ	R: FXD CAR 150kΩ ±5% 1/4W
R48	RCB-AH150K-1	RD25S150KΩJ	R: FXD CAR 150kΩ ±5% 1/4W
R49			Not assigned
R50			Not assigned
R51	RFM-AY18MJM-1	RH2HVS18MΩJ	R: FXD Metal FLM 18MΩ ±5% 2W
R52	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R53	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R54	RCB-AC22M-1	HM1/4 22MΩJ	R: FXD CAR 22MΩ ±5% 1/4W
R55	RCB-AK1M-1	RD50S1MΩJ	R: FXD CAR 1MΩ ±5% 1/2W
R56	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R57	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R58	RCB-AH100K-1	RD25S100KΩJ	R: FXD CAR 100kΩ ±5% 1/4W
R59			Not assigned
R60			Not assigned
R61	RCB-AH6R8-1	RD25S6.8ΩJ	R: FXD CAR 6.8Ω ±5% 1/4W
R62	RVR-CD200K-1	RJ6X200KΩ	R: VAR CERMET 200kΩ

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Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R63	RVR-BT5M-1	VG153KHB5MΩ	R: VAR WW 5MΩ
R64	RVR-CD100K-1	RJ6X100KΩ	R: VAR CERMET 100kΩ
R65	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
C71	CCK-AB22U35V-1	35VB22	C: FXD ELECT 22uF 35V
C72	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10uF 25V
C73	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10uF 25V
C74 thru C78	CSM-ACR01UR5K-1	0.01UF500WV	C: FXD CER 0.01uF +80, -20% 500V
C79	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1uF +80, -20% 50V
C80	CFM-ACR1UR2K-1	431M2003-104K	C: FXD Mylar 0.1uF ±10% 2kV
C81	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10uF ±20% 35V
C82	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10uF ±20% 35V
C83	CFM-ABR047U50V-1	501N5002-473K	C: FXD Mylar 0.047uF ±10% 50V
C84	CCK-AB100U35V-1	35VB100	C: FXD ELECT 100uF 35V
C85	CSM-AA4700P4K-1	DD3250E472Z4KV02	C: FXD CER 4700pF +80, -20% 4kV
C86	CFM-AQR033U4K-1	4MDQ333M	C: FXD Mylar 0.033uF ±20% 4kV
C87 thru C91	CSM-AA4700P4K-1	DD3250E472Z4KV02	C: FXD CER 4700pF +80, -20% 4kV
C92	CSM-AC1000PR5K-1	0.001UF500WV	C: FXD CER 0.001uF +80, -20% 500V
C93	CSM-ACR01UR5K-1	0.01UF500WV	C: FXD CER 0.01uF +80, -20% 500V
C94 thru C97	CMC-AB47PR3K-4	DM10D470J3	C: FXD DIPPED MICA 47pF ±5% 300V
C98	CSM-AA4700P4K-1	DD3250E472Z4KV02	C: FXD CER 4700pF +80, -20% 4kV
C99	CFM-AC1UR2K-1	431M2003-105K	C: FXD Mylar 1uF ±10% 2kV
C100	CSM-AA1500P4K-1	DD3180-362E152P4KV02	C: FXD CER 1500pF +100, -0% 4kV
C101 thru C103	CSM-AA4700P4K-1	DD3250E472Z4KV02	C: FXD CER 4700pF +80, -20% 4kV
C104 thru C107	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047uF +80, -20% 50V
L111	LCL-T00084-1	*	L: FXD Coil
L112 thru L114	LCL-B00018-1	EL0810SKI-471K	L: FXD Coil
L115	LCL-B00375-1	TPF0410-221K	L: FXD Coil
J121	DCB-QS0495-1	TOC-1A12060N	Connector
J122 thru J124	DCB-QS0490-1	TOC-1A06060N	Connector
J125	JCI-AG011JX01-2	VB11SK	Connector
TPK	JCP-AD00LJX02-1	C-55-111A	Terminal
TPG1	JCP-AD001JX06-1	C-55-111A	Terminal
TPP1	JCP-AD00LJX04-1	C-55-111A	Terminal
TPC	MBM-10372A-1	*	Terminal
TPGND	MBM-10372A-1	*	Terminal
T1	LTP-000475-1	*	Transformer
HD1	DPS-000320-1	MR4E-5F-2	HIGH VOLTAGE MULTIPLIER

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1	SIA-2525-3	HA2-2525-5	IC: Operational Amplifier
IC2	SIA-319-1	LM319H	IC: High Speed Dual Comparator
IC3	SIA-318-1	LM318H	IC: Operational Amplifier
IC4	SIA-318-1	LM318H	IC: Operational Amplifier
IC5 thru IC7	SIA-TL082-1	TL082CP	IC: Dual Operational Amplifier
IC8	SIT-7406	SN7406N	IC: Hex Inverter Buffer/Driver
IC9	SIT-74LS00-9	SN74LS00N	IC: Quadruple 2-Input NAND Gate Low Power
Q11 thru Q14	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q15 thru Q18	STN-2N3439	2N3439	Transistor SI NPN
Q19 thru Q22	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q23 thru Q26	STN-2N3439	2N3439	Transistor SI NPN
Q27	STN-2SC505-1	2SC505	Transistor SI NPN
Q28	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q29	STP-2SA1015-1	2SA1015	Transistor SI PNP
Q30	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q31	STP-2SA1015-1	2SA1015	Transistor SI PNP
Q32	SFM-IT1750-1	IT1750	FET Junction N-Channel
Q33			Not assigned
Q34	SFT-A70-18	UPA70A	FET Junction N-Channel
Q35 thru Q38	STP-2SA1015-1	2SA1015	Transistor SI PNP
Q39	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q40	STP-2SA1015-1	2SA1015	Transistor SI PNP
Q41 thru Q43	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q44	STP-2SA1015-1	2SA1015	Transistor SI PNP
Q45	STN-2N3439-1	2N3439	Transistor SI NPN
Q46	STP-2N5416-1	2N5416	Transistor SI NPN
Q47 thru Q50	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q51	STP-2SA1015-1	2SA1015	Transistor SI PNP
Q52	STN-2N3439-1	2N3439	Transistor SI NPN
Q53	STP-2N5416-1	2N5416	Transistor SI NPN
D61 thru D74	SDS-1S953-1	1S953	Diode SI
D75	SDS-1SS97-1	1SS97	Diode SI
D76	SDS-1SS97-1	1SS97	Diode SI
D77			Not assigned
D78	SDS-1S953-1	1S953	Diode SI

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
D79	SDZ-H3-8	RD-3.6E	Zener Diode
D80 thru D83	SDP-F114-Z	A114B	Diode SI
R84 thru R87	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R89	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R90	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R91	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R92	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R93 thru R95	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R96	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R97	RCB-AK18K-1	RD50S18KΩJ	R: FXD CAR 18kΩ ±5% 1/2W
R98	RCB-AK18K-1	RD50S18KΩJ	R: FXD CAR 18kΩ ±5% 1/2W
R99	RCB-AK15K-1	RD50S15KΩJ	R: FXD CAR 15kΩ ±5% 1/2W
R100	RCB-AK15K-1	RD50S15KΩJ	R: FXD CAR 15kΩ ±5% 1/2W
R101	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R102	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R103	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R104	RCB-AH1R2K-1	RD25S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/4W
R105	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R106	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R107 thru R109	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R110	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R111	RCB-AK18K-1	RD50S18KΩJ	R: FXD CAR 18kΩ ±5% 1/2W
R112	RCB-AK18K-1	RD50S18KΩJ	R: FXD CAR 18kΩ ±5% 1/2W
R113	RCB-AK15K-1	RD50S15KΩJ	R: FXD CAR 15kΩ ±5% 1/2W
R114	RCB-AK15K-1	RD50S15KΩJ	R: FXD CAR 15kΩ ±5% 1/2W
R115	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R116	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R117	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R118	RCB-AH1R2K-1	RD25S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/4W
R119	RCB-AH56K-1	RD25S56KΩJ	R: FXD CAR 56kΩ ±5% 1/4W
R120	RCB-AH68K-1	RD25S68KΩJ	R: FXD CAR 68kΩ ±5% 1/4W
R121	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R122 thru R124	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R125	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R126	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R127	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R128	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R129	RCB-AH3R9K-1	RD25S3.9KΩJ	R: FXD CAR 3.9kΩ ±5% 1/4W
R130	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R131	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R132	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R133	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R134	RCB-AH680-1	RD25S680ΩJ	R: FXD CAR 680Ω ±5% 1/4W ADJ R
R135	RCB-AH6R8K-1	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R136	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R137	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R138	RCB-AH51-1	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R139	RCB-AH51-1	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R140	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R141	RCB-AH3R9K-1	RD25S3.9KΩJ	R: FXD CAR 3.9kΩ ±5% 1/4W
R142	RCB-AH6R8K-1	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R143	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R144	RCB-AH1R8K-1	RD25S1.8KΩJ	R: FXD CAR 1.8kΩ ±5% 1/4W
R145	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R146	RCB-AH1R2K-1	RD25S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/4W
R147	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R148	RCB-AH51-1	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R149	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R150	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R151	RCB-AH8R2K-1	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R152	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R153	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R154	RCB-AH51-1	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R155	RCB-AH47K-1	RD25S47KΩJ	R: FXD CAR 47kΩ ±5% 1/4W
R156	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R157	RCB-AH51-1	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R158	RCB-AH3R9K-1	RD25S3.9KΩJ	R: FXD CAR 3.9kΩ ±5% 1/4W
R159	RCB-AH33K-1	RD50S33KΩJ	R: FXD CAR 33kΩ ±5% 1/2W
R160 thru R163	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R164	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R165 thru R167	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R168	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R169	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R170 thru R174	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R175	RCB-AH51-1	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R176	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R177	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R178	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R179	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R180	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R181	RCB-AH51-1	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R182	RCB-AH47K-1	RD25S47KΩJ	R: FXD CAR 47kΩ ±5% 1/4W
R183	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R184	RCB-AH51-1	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R185	RCB-AH3R9K-1	RD25S3.9KΩJ	R: FXD CAR 3.9kΩ ±5% 1/4W

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Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R186	RCB-AH33K-1	RD25S33KΩJ	R: FXD CAR 33kΩ ±5% 1/4W
R187	RCB-AH6R8K-1	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R188	RCB-AH6R8K-1	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R189	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R190	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R191	RCB-AH82-1	RD25S82ΩJ	R: FXD CAR 82Ω ±5% 1/4W
R192	RVR-BE2K-1	X6T2KΩ	R: VAR WW 2kΩ
R193	RVR-BD500-1	X6S500Ω	R: VAR WW 500Ω
R194	RVR-BE1K-1	X6T1KΩ	R: VAR WW 1kΩ
R195	RVR-BD500-1	X6S500Ω	R: VAR WW 500Ω
R196	RVR-BE5K-1	X6T5KΩ	R: VAR WW 5kΩ
R197	RVR-BE2K-1	X6T2KΩ	R: VAR WW 2kΩ
R198	RVR-BE2K-1	X6T2KΩ	R: VAR WW 2kΩ
R199	RVR-CD20K-1	RJ6X20KΩ	R: VAR CERMET 20kΩ
R200 thru R202	RVR-CD200K-1	RJ6X200KΩ	R: VAR CERMET 200kΩ
R203			Not assigned
R204	RVR-BB5K-1	X13S5KΩ	R: VAR WW 5kΩ
R205	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R206	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R207	RCB-AH15K-1	RD25S15KΩJ	R: FXD CAR 15kΩ ±5% 1/4W
R208	RCB-AH390-1	RD25S390ΩJ	R: FXD CAR 390Ω ±5% 1/4W
R209	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R210	RCB-AH47K-1	RD25S47KΩJ	R: FXD CAR 47kΩ ±5% 1/4W
C211 thru C214	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10μF 25V
C215	CSM-ACR01UR5K-1	0.01UF500WV	C: FXD CER 0.01μF +80, -20% 500V
C216	CSM-ACR01UR5K-1	0.01UF500WV	C: FXD CER 0.01μF +80, -20% 500V
C217	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10μF ±20% 16V
C218	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10μF ±20% 16V
C219	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C220	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C221	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10μF ±20% 35V
C222	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10μF ±20% 35V
C223 thru C225	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C226 thru C230	CSM-ACR01UR5K-1	0.01UF500WV	C: FXD CER 0.01μF +80, -20% 500V
C231	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C232	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C233	CMC-AB56PR3K-4	DM10D560J3	C: FXD DIPPED MICA 56pF ±5% 300V
C234	CFM-AA3300PR1K-1	441N1003-332K	C: FXD Mylar 3300pF ±10% 1kV
C235	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10μF ±20% 16V
C236 thru C238	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C239	CSM-AC5P50V-1	5PF50WV	C: FXD CER 5pF ±10% 50V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C240	CTA-AB10U35V-1	111M3502-106M	C: FXD ELECT TANTAL 10μF ±20% 35V
C241	CTA-AB10U35V-1	111M3502-106M	C: FXD ELECT TANTAL 10μF ±20% 35V
C242	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C243	CSM-AC100P50V-1	100PF50WV	C: FXD CER 100pF ±10% 50V
C244	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C245	CMC-AB56PR3K-4	DM10D560J3	C: FXD DIPPED MICA 56pF ±5% 300V
C246	CTA-AB10U35V-1	111M3502-106M	C: FXD ELECT TANTAL 10μF ±20% 35V
C247	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C248	CTM-AA6P-1	ECV1ZW06X53N	C: VAR CER 6pF
C249			Not assigned
C250 thru C252	CFM-ACR1UR2K-1	431M2003-104K	C: FXD Mylar 0.1μF ±10% 2kV
C253	CSM-ACR01UR5K-1	0.01UF500WV	C: FXD CER 0.01μF +80, -20% 500V
C254	CTA-AB10U25V-1	111M2502-106M	C: FXD ELECT TANTAL 10μF ±20% 25V
C255	CSM-AC5P50V-1	5PF50WV	C: FXD CER 5pF ±10% 50V
C256	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C257	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C258	CMC-AB56PR3K-4	DM10D560J3	C: FXD DIPPED MICA 56pF ±5% 300V
C259	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C260	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C261	CTM-AA6P-1	ECV1ZW06X53N	C: VAR CER 6pF
C262	CMC-AB1PR5K-2	DM10C010D5	C: FXD DIPPED MICA 1pF ±0.5% 500V
C263 thru C265	CFM-ACR1UR2K-1	431M2003-104K	C: FXD Mylar 0.1μF ±10% 2kV
C266	CSM-ACR01UR5K-1	0.01UF500WV	C: FXD CER 0.01μF +80, -20% 500V
C267	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C268	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C269	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C270	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
L271 thru L274	LCL-C00014-1	CSL0812-471J	L: FXD Coil 470μH
J281 thru J283	JCP-AA006PX03-1	A-1306	Connector
J284	JCP-AA012PX03-1	A-1312	Connector
R291	JTF-AA001EX02-1	FT-E-15	Teflon Terminal
C301 thru C305	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C306 thru C309	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C310	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C311	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V

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Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1	SIT-74LS73	SN74LS73N	IC: Dual J-K Master-Slave Flip Flop Low Power
IC2	SIT-74LS73	SN74LS73N	IC: Dual J-K Master-Slave Flip Flop Low Power
IC3	SIT-74121	SN74121N	IC: Monostable Multivibrator
IC4	SIT-74LS138	SN74LS138N	IC: Decoder/Demultiplexer Low Power
IC5	SIT-74LS123	SN74LS123N	IC: Dual Retriggerable Monostable Multivibrator with Clear
IC6	SIT-74LS00	SN74LS00N	IC: Quadruple 2-Input NAND Gate Low Power
IC7	SIT-74LS151	SN74LS151N	IC: Data Selector/Multiplexer Low Power
IC8	SIT-74LS02	SN74LS02N	IC: Quadruple 2-Input NOR Gate Low Power
IC9	SIT-74LS02	SN74LS02N	IC: Quadruple 2-Input NOR Gate Low Power
IC10	SIT-74LS175	SN74LS175N	IC: Quad D-Type Flip Flop Low Power
IC11	SIT-74LS174	SN74LS174N	IC: Hex D-Type Flip Flop Low Power
IC12	SIT-74LS73	SN74LS73N	IC: Dual J-K Master-Slave Flip Flop Low Power
IC13	SIT-74LS273	SN74LS273N	IC: Octal D-Type Flip Flop Low Power
IC14	SIT-74LS244	SN74LS244N	IC: Quadruple Bus Tranceiver Low Power
IC15	SIT-74LS04	SN74LS04N	IC: Hex Inverter Low Power
IC16	SIT-74LS00	SN74LS00N	IC: Quadruple 2-Input NAND Gate Low Power
IC17	SIT-74LS74	SN74LS74N	IC: Dual D-Type Positive-Edge-Triggered Flip Flop with Preset AND Clear Low Power
IC18	SIT-74LS393	SN74LS393N	IC: Dual 4-bit Binary Counter Low Power
IC19	SIT-74LS273	SN74LS273N	IC: Octal D-Type Flip Flop Low Power
IC20	SIT-74LS138	SN74LS138N	IC: Decoder/Demultiplexer Low Power
IC21	SIT-74LS14	SN74LS14N	IC: Hex Schmitt-Trigger Inverter Low Power
IC22	SIT-74LS08	SN74LS08N	IC: Quadruple 2-Input Positive AND-Gate Low Power
IC23	SIT-74LS14	SN74LS14N	IC: Hex Schmitt-Trigger Inverter Low Power
IC24	SIT-74LS73	SN74LS73N	IC: Dual J-K Master-Slave Flip Flop Low Power
IC25	SIA-339-1	LM339	IC: Quadruple Differential Comparator
IC26	SIA-339-1	LM339	IC: Quadruple Differential Comparator
IC27	SIA-301A-1	LM301A	IC: Operational Amplifier
IC28	SIA-1408-1	AM1408L8	IC: 8-bit Multiplying D/A Converter
IC29	SIA-301A-1	LM301A	IC: Operational Amplifier
IC30	SIA-356A-1	LF356AH	IC: Junction FET INPUT Type Operational Amplifier
IC31	SIA-DG201-1	DG201BK	IC: Quad Monolithic SPST CMOS ANAlOG Switch
IC32	SIA-308A-1	LM308AH	IC: Operational Amplifier
IC33	SIA-356-1	LF356H	IC: Junction FET INPUT Type Operational Amplifier
IC34	SIA-311-1	LM311H	IC: Voltage Comparator
IC35	SIA-TL084-6	TL084ACN	IC: JFET-Input Operational Amplifier
IC36	SIA-311-1	LM311H	IC: Voltage Comparator
IC37	SIA-301A-1	LM301A	IC: Operational Amplifier
IC38	SIA-311-1	LM311H	IC: Voltage Comparator
IC39	SIA-356-1	LF356H	IC: Junction FET INPUT Type Operational Amplifier
IC40	SIA-311-1	LM311-1	IC: Voltage Comparator
Q41	SFN-2SK113-18	2SK113Y	FET Junction N-Channel
Q42	SFN-2N4393-18	2N4393	FET Junction N-Channel
Q43	SFN-2SK113-18	2SK113Y	FET Junction N-Channel

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
Q44	SFN-2N4393-18	2N4393	FET Junction N-Channel
Q45	SFN-2N4393-18	2N4393	FET Junction N-Channel
Q46	STP-2SA1015-1	2SA1015	Transistor SI NPN
Q47	SFN-2N4393-18	2N4393	FET Junction N-Channel
Q48	SFN-2N4393-18	2N4393	FET Junction N-Channel
D51	SDS-1S953-1	1S953	Diode SI
R61	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R62	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R63	RMF-AR12KFK-1	SN14K2E12KΩF	R: FXD Metal FLM 12kΩ ±1% 1/4W
R64	RVR-BD2K-1	X6S2KΩ	R: VAR WW 2kΩ
R65	RVR-BE200-1	X6T200Ω	R: VAR WW 200Ω
R66	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R67	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R68	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R69	RCB-AH1R5K-1	RD25S1.5KΩ	R: FXD CAR 1.5kΩ ±5% 1/4W
R70 thru R76	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R77 thru R81	RCB-AH33K-1	RD25S33KΩJ	R: FXD CAR 33kΩ ±5% 1/4W
R82	RMF-AR18KFK-1	SN14K2E18KΩF	R: FXD Metal FLM 18kΩ ±1% 1/4W
R83	RVR-BE5K-1	X6T5KΩ	R: VAR WW 5kΩ
R84	RMF-AR2KFK-1	SN14K2E2KΩF	R: FXD Metal FLM 2kΩ ±1% 1/4W
R85	RMF-AR20KFK-1	SN14K2E20KΩF	R: FXD Metal FLM 20kΩ ±1% 1/4W
R86	RMF-AR1MFK-1	SN14K2E1MΩF	R: FXD Metal FLM 1MΩ ±1% 1/4W
R87	RMF-AR1MFK-1	SN14K2E1MΩF	R: FXD Metal FLM 1MΩ ±1% 1/4W
R88	RCB-AH33K-1	RD25S33KΩJ	R: FXD CAR 33kΩ ±5% 1/4W
R89	RCB-AH33K-1	RD25S33KΩJ	R: FXD CAR 33kΩ ±5% 1/4W
R90	RCB-AH1R5K-1	RD25S1.5KΩJ	R: FXD CAR 1.5kΩ ±5% 1/4W
R91	RCB-AH1R5K-1	RD25S1.5KΩJ	R: FXD CAR 1.5kΩ ±5% 1/4W
R92			Not assigned
R93	RMF-AR5KFK-1	SN14K2E5KΩF	R: FXD Metal FLM 5kΩ ±1% 1/4W
R94	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R95	RVR-BD2K-1	X6S2KΩ	R: VAR WW 2kΩ
R96	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R97	RMF-AR12KFK-1	SN14K2E12KΩF	R: FXD Metal FLM 12kΩ ±1% 1/4W
R98	RMF-AR100QFK-1	SN14K2E100ΩF	R: FXD Metal FLM 100Ω ±1% 1/4W
R99	RMF-AR2R2KFK-1	SN14K2E2.2KΩF	R: FXD Metal FLM 2.2kΩ ±1% 1/4W
R100	RMF-AR2R2KFK-1	SN14K2E2.2KΩF	R: FXD Metal FLM 2.2kΩ ±1% 1/4W
R101	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R102	RMF-AR100QFK-1	SN14K2E100ΩF	R: FXD Metal FLM 100Ω ±1% 1/4W
R103	RMF-AR2R2KFK-1	SN14K2E2.2KΩF	R: FXD Metal FLM 2.2kΩ ±1% 1/4W
R104 thru R106	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R107	RCB-AH4R7K-1	RD25S4.7KΩF	R: FXD CAR 4.7kΩ ±1% 1/4W
R108	RMF-AR2R2KFK-1	SN14K2E2.2KΩF	R: FXD Metal FLM 2.2kΩ ±1% 1/4W
R109	RMF-AR9R1KFK	SN14K2E9.1KΩF	R: FXD Metal FLM 9.1kΩ ±1% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R110	RMF-AR5KFK	SN14K2E5KΩF	R: FXD Metal FLM 5kΩ ±1% 1/4W
R111	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R112	RCB-AH33K-1	RD25S33KΩJ	R: FXD CAR 33kΩ ±5% 1/4W
R113			Not assigned
R114	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R115	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R116	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R117	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R118	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R119	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R120	RCB-AH39K-1	RD25S39KΩJ	R: FXD CAR 39kΩ ±5% 1/4W
R121	RMF-AR100ΩFK-1	SN14K2E100ΩF	R: FXD Metal FLM 100Ω ±1% 1/4W
R122	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R123	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R124	RVR-BE1K-1	X6T1KΩ	R: VAR WW 1kΩ
R125	RMF-AR12KFK-1	SN14K2E12KΩF	R: FXD Metal FLM 12kΩ ±1% 1/4W
R126	RMF-AR2R2KFK-1	SN14K2E2.2KΩF	R: FXD Metal FLM 2.2kΩ ±1% 1/4W
R127	RMF-AR2R2KFK-1	SN14K2E2.2KΩF	R: FXD Metal FLM 2.2kΩ ±1% 1/4W
R128	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R129	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R130	RVR-BE1K-1	X6T1KΩ	R: VAR WW 1kΩ
R131	RMF-AR12KFK-1	SN14K2E12KΩF	R: FXD Metal FLM 12kΩ ±1% 1/4W
R132	RMF-AR2R2KFK-1	SN14K2E2.2KΩF	R: FXD Metal FLM 2.2kΩ ±1% 1/4W
R133	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R134	RCB-AH12K-1	RD25S12KΩJ	R: FXD CAR 12kΩ ±5% 1/4W
R135	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R136	RCB-AH47K-1	RD25S47KΩJ	R: FXD CAR 47kΩ ±5% 1/4W
R137	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R138	RCB-AH270-1	RD25S270ΩJ	R: FXD CAR 270Ω ±5% 1/4W
R139	RCB-AH560K	RD25S560KΩJ	R: FXD CAR 560kΩ ±5% 1/4W
C141	CMC-AB15PR5K-6	DM10C150K5	C: FXD DIPPED MICA 15pF ±10% 500V
C142 thru C144	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C145	CSM-AC33P50V-1	33PF50WV	C: FXD CER 33pF ±10% 50V
C146	CTA-AB47U10V-1	221M1002-476M	C: FXD ELECT TANTAL 47μF ±20% 10V
C147	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C148 thru C153	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C154	CTA-AB22U35V-1	221M3502-226M	C: FXD ELECT TANTAL 22μF ±20% 35V
C155	CFM-AAR01UR1K-1	441N1003-103K	C: FXD Mylar 0.01μF ±10% 1kV
C156	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C157	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C158	CFM-AP10UR1K-1	931M1003-106K	C: FXD Mylar 10μF ±10% 1kV
C159 thru C164	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C165	CSM-AC33P50V-1	33PF50WV	C: FXD CER 33pF ±10% 50V
C166	CTA-AB22U35V-1	221M3502-226M	C: FXD ELECT 22μF ±20% 35V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C167	CSM-AC33P50V-1	33PF50WV	C: FXD CER 33pF ±10% 50V
C168 thru C170	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C171	CSM-AC33P50V-1	33PF50WV	C: FXD CER 33pF ±10% 50V
C172 thru C181	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C182	CTA-AC1U50V-2	244M5002-105M	C: FXD ELECT TANTAL 1μF ±20% 50V
C183	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C184	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C185	CSM-AC33P50V-1	33PF50WV	C: FXD CER 33pF ±10% 50V
C186	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C187	CTA-AB22U35V-1	221M3502-226M	C: FXD ELECT TANTAL 22μF ±20% 35V
C188	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C189	CTA-AB22U35V-1	221M3502-226M	C: FXD ELECT TANTAL 22μF ±20% 35V
C190	CTA-AC1U50V-2	244M5002-105M	C: FXD ELECT TANTAL 1μF ±20% 50V
C191 thru C196	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C197 thru C200	CTA-AB22U35V-1	221M3502-226M	C: FXD ELECT TANTAL 22μF ±20% 35V
C201 thru C207	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C208 thru C214	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10μF ±20% 16V
C215	CTA-AB47U10V-1	221M1002-476M	C: FXD ELECT TANTAL 47μF ±20% 10V
C216	CTA-AB47U10V-1	221M1002-476M	C: FXD ELECT TANTAL 47μF ±20% 10V
C217	CTA-AC1U50V-2	244M5002-105M	C: FXD ELECT TANTAL 1μF ±20% 50V
C218 thru C221	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C222 thru C224	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C225 thru C227	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10μF ±20% 16V
C228	CSM-AC470P50V-1	470PF50WV	C: FXD CER 470pF ±10% 50V
C229	CSM-AC33P50V-1	33PF50WV	C: FXD CER 33pF ±10% 50V
L231 thru L233	LCL-C00013	CSL0812-181J	L: FXD Coil
J251	JCP-AA003PX06-1	A-1303	Connector
IC261	SIA-311-1	LM311H	IC: Voltage Comparator
IC262	SIA-301A-1	LM301A	IC: Operational Amplifier
IC263	SIA-301A-1	LM301A	IC: Operational Amplifier
IC264	SIT-74LS73-9	SN74LS73N	IC: Dual J-K Master-Slave Flip Flop Low Power
IC265	SIT-74LS08-1	SN74LS08N	IC: Quadruple 2-Input AND Gate Low Power
IC266	SIT-74LS00-1	SN74LS00N	IC: Quadruple 2-Input NAND Gate Low Power

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1	SIA-318-1	LM318H	IC: Operational Amplifier
IC2	SIA-318-1	LM318H	IC: Operational Amplifier
IC3 thru IC6	SIA-DG201-1	DG201BK	IC: Quad Monolithic SPST CMOS Analog Switch
IC7	SIA-356-1	LF356H	IC: Junction FET INPUT Type Operational Amplifier
IC8	SIA-308A-1	LM308AH	IC: Operational Amplifier
IC9 thru IC13	SIA-356-1	LF356H	IC: Junction FET INPUT Type Operational Amplifier
IC14	SIA-DG201-1	DG201BK	IC: Quad Monolithic SPST CMOS Analog Switch
IC15	SIA-DG201-1	DG201BK	IC: Quad Monolithic SPST COMOS Analog Switch
IC16	SIA-TL084-6	TL084ACN	IC: JFET Input Operational Amplifier
IC17	SIA-311-1	LM311H	IC: Voltage Comparator
IC18	SIA-TL084-1	TL084ACN	IC: JFET Input Operational Amplifier
IC19	SIA-DG201-1	DG201BK	IC: Quad Monolithic SPST CMOS Analog Switch
IC20	SIA-TL084-1	TL084ACN	IC: JFET Input Operational Amplifier
IC21	SIA-318-1	LM318H	IC: Operational Amplifier
IC22	SIA-2525-3	HA2-2525-5	IC: Operational Amplifier
IC23	SIA-2525-3	HA2-2525-5	IC: Operational Amplifier
IC24	SIA-318-1	LM318H	IC: Operational Amplifier
IC25	SIA-319-1	LM319H	IC: High Speed Dual Comparator
IC26	SIA-319-1	LM319H	IC: High Speed Dual Comparator
IC27	SIA-318-1	LM318H	IC: Operational Amplifier
IC28	SIA-2525-3	HA2-2525-5	IC: Operational Amplifier
IC29	SIA-2525-3	HA2-2525-5	IC: Operational Amplifier
IC30	SIT-74LS138	SN74LS138N	IC: Decoder/Demultiplexer Low Power
IC31	SIT-74LS174	SN74LS174N	IC: Hex D-Type Flip Flop Low Power
IC32	SIT-74LS273	SN74LS273N	IC: Octal D-Type Flip Flop Low Power
IC33	SIT-74LS273	SN74LS273N	IC: Octal D-Type Flip Flop Low Power
IC34	SIT-7407	SN7407N	IC: Hex Buffer/Driver with Open-Collector High-Voltage Output
IC35	SIT-7407	SN7407N	IC: Hex Buffer/Driver with Open-Collector High-Voltage Ouput
IC36	SIT-74LS04N	SN74LS04N	IC: Hex Inverter Low Power
IC37	SIT-74LS04	SN74LS04N	IC: Hex Inverter Low Power
IC38	SIT-74LS123	SN74LS123N	IC: Dual Retriggerable Monostable Multivibrator with Clear Low Power
IC39	SIT-74LS11	SN74LS11N	IC: Triple 3-Input Positive-AND Gate Low Power
Q51 thru Q56	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q57	STP-2SA1015-1	2SA1015	Transistor SI PNP
Q58	STN-2SC2901-1	2SC2901	Transistor SI NPN
Q59	STP-2SA1015-1	2SA1015	Transistor SI PNP
Q60	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q61	STN-2SC1815-15	2SC1815GR	Transistor SI NPN

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
Q62 thru Q68	STP-2SA1015-1	2SA1015	Transistor SI PNP
Q69	STP-2SA711-1	2SA711	Transistor SI PNP
Q70	STP-2SA711-1	2SA711	Transistor SI PNP
Q71	SFT-A71-18	UPA71A	FET Junction N-Channel
Q72	SFT-A71-18	UPA71A	FET Junction N-Channel
Q73	SFN-2N4859-18	2N4859	FET Junction N-Channel
Q74	SFN-2SK30-1	2SK30A-TM	FET Junction N-Channel
Q75	SFN-2N4859-18	2N4859	FET Junction N-Channel
Q76	SFN-2SK30-1	2SK30A-TM	FET Junction N-Channel
Q77 thru Q79	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q80	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q81	STP-2SA1015-1	2SA1015	Transistor SI PNP
D91 thru D107	SDS-1S953	1S953	Diode SI
D108 thru D111	SDS-1SS97-1	1SS97	Diode SI
D112 thru D115	SDS-1S953	1S953	Diode SI
R119	RMF-AR39KFK-1	SN14K2E39KΩF	R: FXD Metal FLM 39KΩ ±1% 1/4W
R120	RMF-AR39KFK-1	SN14K2E39KΩF	R: FXD Metal FLM 39KΩ ±1% 1/4W
R121	RMF-AR560QFK-1	SN14K2E560ΩF	R: FXD Metal FLM 560Ω ±1% 1/4W
R122	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R123	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R124	RMF-AR12KFK-1	SN14K2E12KΩF	R: FXD Metal FLM 12kΩ ±1% 1/4W
R125	RMF-AR3KFK-1	SN14K2E3KΩF	R: FXD Metal FLM 3kΩ ±1% 1/4W
R126	RMF-AR18KFK-1	SN14K2E18KΩF	R: FXD Metal FLM 18kΩ ±1% 1/4W
R127	RMF-AR2KFK-1	SN14K2E2KΩF	R: FXD Metal FLM 2kΩ ±1% 1/4W
R128	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R129	RMF-AR9R1KFK-1	SN14K2E9.1KΩF	R: FXD Metal FLM 9.1kΩ ±1% 1/4W
R130	RVR-BE2K-1	X6T2KΩ	R: VAR WW 2kΩ
R131	RMF-AR2R2KFK-1	SN14K2E2.2KΩF	R: FXD Metal FLM 2.2kΩ ±1% 1/4W
R132	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R133	RMF-AR3R3KFK-1	SN14K2E3.3KΩF	R: FXD Metal FLM 3.3kΩ ±1% 1/4W
R134	RVR-BE500-1	X6T500Ω	R: VAR WW 500Ω
R135	RMF-AR5R6KFK-1	SN14K2E5.6KΩF	R: FXD Metal FLM 5.6kΩ ±1% 1/4W
R136	RMF-AR470QFK-1	SN14K2E470ΩF	R: FXD Metal FLM 470Ω ±1% 1/4W
R137	RMF-AR1R2KFK-1	SN14K2E1.2KΩF	R: FXD Metal FLM 1.2kΩ ±1% 1/4W
R138	RMF-AR750QFK-1	SN14K2E750ΩF	R: FXD Metal FLM 750Ω ±1% 1/4W
R139			Not assigned
R140			Not assigned
R141	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R142			Not assigned
R143	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R144	RMF-AR3KFK-1	SN14K2E3KΩF	R: FXD Metal FLM 3kΩ ±1% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R145	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R146	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R147	RVR-BE200-1	X6T200Ω	R: VAR WW 200Ω
R148	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R149	RMF-AR22KFK-1	SN14K2E22KΩF	R: FXD Metal FLM 22kΩ ±1% 1/4W
R150	RVR-BE500-1	X6T500Ω	R: VAR WW 500Ω
R151	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R152	RMF-AR47KFK-1	SN14K2E47KΩF	R: FXD Metal FLM 47kΩ ±1% 1/4W
R153	RVR-BE500-1	X6T500Ω	R: VAR WW 500Ω
R154	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R155	RMF-AR120KFK-1	SN14K2E120KΩF	R: FXD Metal FLM 120kΩ ±1% 1/4W
R156	RVR-BE20K-1	X6T20KΩ	R: VAR WW 20kΩ
R157	RMF-AR18KFK-1	SN14K2E18KΩF	R: FXD Metal FLM 18kΩ ±1% 1/4W
R158	RVR-BE5K-1	X6T5KΩ	R: VAR WW 5kΩ
R159			Not assigned
R160	RMF-AR500QFK-1	SN14K2E500ΩF	R: FXD Metal FLM 500Ω ±1% 1/4W
R161 thru R163	RMF-AR2R2KFK-1	SN14K2E2.2KΩF	R: FXD Metal FLM 2.2kΩ ±1% 1/4W
R164	RVR-BE500	X6T500Ω	R: VAR WW 500Ω
R165	RMF-AR2KFK-1	SN14K2E2KΩF	R: FXD Metal FLM 2kΩ ±1% 1/4W
R166	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R167	RMF-AR560KFK-1	SN14K2E560KΩF	R: FXD Metal FLM 560kΩ ±1% 1/4W
R168	RMF-AR500QFK-1	SN14K2E500ΩF	R: FXD Metal FLM 500Ω ±1% 1/4W
R169	RAY-AA100K6-1	TMR6-104	R: FXD COM 100kΩ
R170	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R171	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R172	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R173	RCB-AH15K-1	RD25S15KΩJ	R: FXD CAR 15kΩ ±5% 1/4W
R174	RVR-CB1K-1	RJ6P1KΩ	R: VAR CERMET 1kΩ
R175	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R176	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R177	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R178	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R179	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R180	RVR-CD5K-1	RJ6X5KΩ	R: VAR CERMET 5kΩ
R181	RMF-AR8R2KFK-1	SN14K2E8.2KΩF	R: FXD Metal FLM 8.2KΩ ±1% 1/4W
R182	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10KΩ ±1% 1/4W
R183	RVR-CD500-1	RJ6X500Ω	R: VAR CERMET 500Ω
R184			Not assigned
R185	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10KΩ ±1% 1/4W
R186	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10KΩ ±1% 1/4W
R187	RMF-AR8R2KFK-1	SN14K2E8.2KΩF	R: FXD Metal FLM 8.2KΩ ±1% 1/4W
R188	RVR-CD5K-1	RJ6X5KΩ	R: VAR CERMET 5kΩ
R189	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R190	RVR-CD1K-1	RJ6X1KΩ	R: VAR CERMET 1kΩ
R191	RMF-AR12KFK-1	SN14K2E12KΩF	R: FXD Metal FLM 12KΩ ±1% 1/4W
R192	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10KΩ ±1% 1/4W
R193	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R194	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R195	RMF-AR5KFK-1	SN14K2E5KΩF	R: FXD Metal FLM 5kΩ ±1% 1/4W
R196	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R197	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R198	RCB-AH15K-1	RD25S15KΩJ	R: FXD CAR 15kΩ ±5% 1/4W
R199	RCB-AH2R2K-1	RD25S2R2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R200	RCB-AH12K-1	RD25S12KΩJ	R: FXD CAR 12kΩ ±5% 1/4W
R201	RCB-AH12K-1	RD25S12KΩJ	R: FXD CAR 12kΩ ±5% 1/4W
R202	RCB-AH2R7K-1	RD25S2.7KΩJ	R: FXD CAR 2.7kΩ ±5% 1/4W
R203	RAY-AA10K6-1	TMR6-103	R: FXD COM 10kΩ
R204	RMF-AR4R7KFK-1	SN14K2E4.7KΩF	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R205	RMF-AR9R31KFK-1	SN14K2E9.31KΩF	R: FXD Metal FLM 9.31kΩ ±1% 1/4W
R206	RMF-AR18R7KFK-1	SN14K2E18.7KΩF	R: FXD Metal FLM 18.7kΩ ±1% 1/4W
R207	RMF-AR4R7KFK-1	SN14K2E4.7KΩF	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R208	RMF-AR9R31KFK-1	SN14K2E9.31KΩF	R: FXD Metal FLM 9.31kΩ ±1% 1/4W
R209	RMF-AR18R7KFK-1	SN14K2E18.7KΩF	R: FXD Metal FLM 18.7kΩ ±1% 1/4W
R210	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10KΩ ±5% 1/4W
R211	RCB-AH2R7K-1	RD25S2.7KΩJ	R: FXD CAR 2.7kΩ ±5% 1/4W
R212	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10KΩ ±5% 1/4W
R213	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R214	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R215	RMF-AR68QFK-1	SN14K2E68ΩF	R: FXD Metal FLM 68Ω ±1% 1/4W
R216	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R217	RMF-AR68QFK-1	SN14K2E68ΩF	R: FXD Metal FLM 68Ω ±1% 1/4W
R218	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R219	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R220	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R221	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R222	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R223	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R224	RCB-AH15K-1	RD25S15KΩJ	R: FXD CAR 15kΩ ±5% 1/4W
R225	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R226	RCB-AH15K-1	RD25S15KΩJ	R: FXD CAR 15kΩ ±5% 1/4W
R227	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R228	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R229 thru R231	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R232	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R233	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R234	RCB-AH3R9K-1	RD25S3.9KΩJ	R: FXD CAR 3.9kΩ ±5% 1/4W
R235	RCB-AH12K-1	RD25S12KΩJ	R: FXD CAR 12kΩ ±5% 1/4W
R236	RVR-CB1K-1	RJ6P1KΩ	R: VAR CERMET 1kΩ
R237	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R238	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R239	RCB-AH8R2K-1	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R240	RVR-CB5K-1	RJ6P5KΩ	R: VAR CERMET 5kΩ

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R241 thru R243	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R244	RCB-AH5R1K-1	RD25S5.1KΩJ	R: FXD CAR 5.1kΩ ±5% 1/4W
R245	RCB-AH1R2K-1	RD25S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/4W
R246	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R247	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R248	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R249	RCB-AH6R8K-1	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R250	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R251	RCB-AH3R9K-1	RD25S3.9KΩJ	R: FXD CAR 3.9kΩ ±5% 1/4W
R252	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R253	RCB-AH8R2K-1	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R254	RVR-CB5K-1	RJ6P5KΩ	R: FXD CERMET 5kΩ
R255	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R256	RVR-CB1K-1	RJ6P1KΩ	R: VAR CERMET 1kΩ
R257	RCB-AH12K-1	RD25S12KΩJ	R: FXD CAR 12kΩ ±5% 1/4W
R258	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10KΩ ±5% 1/4W
R259	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R260	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10KΩ ±1% 1/4W
R261	RMF-AR5R1KFK-1	SN14K2E5.1KΩF	R: FXD Metal FLM 5.1kΩ ±1% 1/4W
R262	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R263	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R264	RMF-AR12KFK-1	SN14K2E12KΩF	R: FXD Metal FLM 12KΩ ±1% 1/4W
R265	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R266	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R267	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R268	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R269	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R270	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R271	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R272	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R273	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R274	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R275	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R276	RCB-AH12K-1	RD25S12KΩJ	R: FXD CAR 12kΩ ±5% 1/4W
R277 thru R279	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R280	RMF-AR5R1KFK-1	SN14K2E5.1KΩF	R: FXD Metal FLM 5.1kΩ ±1% 1/4W
R281	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R282	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R283	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R284	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R285	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R286	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R287	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R288	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R289	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R290	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R291	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R292	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R293	RVR-CB5K-1	RJ6P5KΩ	R: VAR CERMET 5kΩ
R294	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R295	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R296	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R297	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R298	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R299	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R300	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R301	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R302	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R303	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R304	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R305	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R306	RVR-CB5K-1	RJ6P5KΩ	R: VAR CERMET 5kΩ
R307	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R308	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R309	RVR-CB1K-1	RJ6P1KΩ	R: VAR CERMET 1kΩ
R310	RCB-AH12K-1	RD25S12KΩJ	R: FXD CAR 12kΩ ±5% 1/4W
R311	RVR-CB200K-1	RJ6P200KΩ	R: VAR CERMET 200kΩ
R312	RMF-AR220KFK-1	SN14K2E220KΩF	R: FXD Metal FLM 220kΩ ±1% 1/4W
R313	RVR-BE10K-1	X6T10KΩ	R: VAR WW 10kΩ
R314	RMF-AR470KFK-1	SN14K2E470KΩF	R: FXD Metal FLM 470kΩ ±1% 1/4W
R315	RVR-BE10K-1	X6T10KΩ	R: VAR WW 10kΩ
R316	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R317	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R318	RMF-AR1R5KFK-1	SN14K2E1.5KΩF	R: FXD Metal FLM 1.5kΩ ±1% 1/4W
R319	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
C321	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C322	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C323	CFM-AA1000PR1K-1	441N1003-102K	C: FXD Mylar 1000pF ±10% 1kV
C324	CFM-AA3300PR1K-1	441N1003-332K	C: FXD Mylar 3300pF ±10% 1kV
C325	CFM-AAR01UR1K-1	441N1003-103K	C: FXD Mylar 0.01μF ±10% 1kV
C326	CFM-AAR033UR1K-1	441N1003-333K	C: FXD Mylar 0.033μF ±10% 1kV
C327	CFM-ACR1UR2K-1	431M2003-104K	C: FXD Mylar 0.1μF ±10% 2kV
C328	CFM-ACR33UR2K-1	431M2003-334K	C: FXD Mylar 0.33μF ±10% 2kV
C329 thru C334	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C335	CSM-ACR01050V-1	0.01UF 50WV	C: FXD CER 0.01μF +80, -20% 50V
C336			Not assigned
C337 thru C339	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C340	CFM-AA2200PR1K-1	441N1003-222K	C: FXD Mylar 2200pF ±10% 1kV
C341	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C342	CFM-AS3300P50V-1	505N5002-332K	C: FXD Mylar FLM 3300pF ±10% 50V

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Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C343	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C344	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C345	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C346	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C347	CFM-AA1500PR1K-1	441N1003-152K	C: FXD Mylar 1500pF ±10% 1kV
C348	CFM-AA1500PR1K-1	441N1003-152K	C: FXD Mylar 1500pF ±10% 1kV
C349	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C350	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C351	CMC-AB10PR5K-6	DM10C100K5	C: FXD DIPPED MICA 10pF ±10% 500V
C352	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C353	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C354	CTM-AC50P-1	ECV1ZW50X32	C: VAR CER 50pF
C355	CMC-AB270PR3K-4	DM10D271J3	C: FXD DIPPED MICA 270pF ±5% 300V
C356	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C357	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C358	CFM-AA22000PR1K-1	441N1003-222K	C: FXD Mylar 2200pF ±10% 1kV
C359	CMC-AB56PR3K-4	DM10D560J3	C: FXD DIPPED MICA 56pF ±5% 300V
C360	CMC-AB33PR5K-4	DM10D330J5	C: FXD DIPPED MICA 33pF ±5% 500V
C361	CMC-AB10PR5K-6	DM10C100K5	C: FXD DIPPED MICA 10pF ±10% 500V
C362	CMC-AB20PR5K-6	DM10C200K5	C: FXD DIPPED MICA 20pF ±10% 500V
C363	CTM-AC20P-1	ECV1ZW20X32	C: VAR CER 20pF
C364	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C365	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C366	CTM-AC50P-1	ECV1ZW50X32	C: VAR CER 50pF
C367	CMC-AB270PR3K-4	DM10D271J3	C: FXD DIPPED MICA 270pF ±5% 300V
C368	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C369	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C370	CFM-AA2200PR1K-1	441N1003-222K	C: FXD Mylar 2200pF ±10% 1kV
C371	CMC-AB56PR3K-4	DM10D560J3	C: FXD DIPPED MICA 56pF ±5% 300V
C372	CMC-AB33PR5K-4	DM10D330J5	C: FXD DIPPED MICA 33pF ±5% 500V
C373	CMC-AB10PR5K-6	DM10C100K5	C: FXD DIPPED MICA 10pF ±10% 500V
C374	CMC-AB20PR5K-6	DM10C200K5	C: FXD DIPPED MICA 20pF ±10% 500V
C375	CTM-AC20P-1	ECV1ZW20X32	C: VAR CER 20pF
C376 thru C380	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C381	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C382	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C383	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C384	CFM-AA1500PR1K-1	441N1003-152K	C: FXD Mylar 1500pF ±10% 1kV
C385	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C386	CMC-AB240PR3K-4	DM10D241J3	C: FXD DIPPED MICA 240pF ±5% 300V
C387	CFM-AA1500PR1K-1	441N1003-152K	C: FXD Mylar 1500pF ±10% 1kV
C388	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C389	CFM-AA1000PR1K-1	441N1003-103K	C: FXD Mylar 1000pF ±10% 1kV
C390	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C391	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C392 thru C398	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10μF ±20% 16V
C399 thru C403	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C404	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C405	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C406 thru C434	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C435	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C436	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C437 thru C465	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C466	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C467	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C468	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C469	CSM-AC33P50V-1	33PF50WV	C: FXD CER 33pF ±10% 50V
C470	CMC-AB20PR5K-6	DM10C200K5	C: FXD DIPPED MICA 20pF ±10% 500V
C471	CMC-AB20PR5K-6	DM10C200K5	C: FXD DIPPED MICA 20pF ±10% 500V
C472	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C473	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C474	CMC-AB20PR5K-6	DM10C200K5	C: FXD DIPPED MICA 20pF ±10% 500V
C475	CMC-AB20PR5K-6	DM10C200K5	C: FXD DIPPED MICA 20pF ±10% 500V
C476	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
L481 thru L483	LCL-C00013-1	CSL0812-181J	L: FXD Coil
L484	LCL-C00012-1	CSL0609-471K	L: FXD Coil
L485	LCL-B00376-1	TPF0410-331K	L: FXD Coil
R494 thru R496	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1KΩ ±5% 1/4W
R497	RMF-AR2R7KFK-1	SN14K2E2.7KΩF	R: FXD Metal FLM 2.7KΩ ±1% 1/4W
R498	RMF-AR2R7KFK-1	SN14K2E2.7KΩF	R: FXD Metal FLM 2.7KΩ ±1% 1/4W
R506	RCB-AH51-1	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R507	RCB-AH51-1	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R508	RVR-CB2K-1	RJ6P2KΩ	R: VAR CERMET 2KΩ

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1	SIT-74LS73	SN74LS73N	IC: Dual J-K Master-Slave Flip Flop Low Power
IC2	SIT-74LS390	SN74LS390N	IC: Dual Decode Counter Low Power
IC3	SIT-74ALS161-1	SN74ALS161N	IC: Synchronous 4-bit Counter Low Power
IC4	SMB-74S288-3	MB7051	IC: 256-bit Bipolar ROM
IC5	SIT-74LS153	SN74LS153N	IC: Dual 4-Line to 1-Line Data Selector/ Multiplexer Low Power
IC6	SIT-2504	AM2504PC	IC: 12 bit Successive Approximation Register
IC7	SIT-74LS08	SN74LS08N	IC: Quadruple 2-Input Positive AND Gate Low Power
IC8	SIT-74LS73	SN74LS73N	IC: Dual J-K Master-Slave Flip Flop Low Power
IC9	SIT-74LS14	SN74LS14N	IC: Hex Schmitt-Trigger Inverter Low Power
IC10	SIT-74LS74	SN74LS74N	IC: Dual D-Type Positive-Edge-Triggered Flip Flop with Preset AND Clear Low Power
IC11	SIT-74LS374	SN74LS374N	IC: Octal D-Type Flip Flop Low Power
IC12	SIT-74LS75	SN74LS75N	IC: 4-bit Bistable Latch Low Power
IC13	SIT-74LS73	SN74LS73N	IC: Dual J-K Master-Slave Flip Flop Low Power
IC14	SIT-74LS00	SN74LS00N	IC: Quadruple 2-Input Positive NAND Gate Low Power
IC15	SIT-74LS132	SN74LS132N	IC: Quadruple 2-Input Positive-NAND Schmitt Trigger Low Power
IC16	SIT-74LS04	SN74LS04N	IC: Hex Inverter Low Power
IC17	SIT-74LS00	SN74LS00N	IC: Quadruple 2-Input Positive NAND Gate Low Power
IC18	SIT-74LS393	SN74LS393N	IC: Dual 4-bit Binary Counter Low Power
IC19	SIT-74LS08	SN74LS08N	IC: Quadruple 2-Input Positive AND Gate Low Power
IC20	SIT-74LS00	SN74LS00N	IC: Quadruple 2-Input Positive NAND Gate Low Power
IC21	SIT-74LS244	SN74LS244N	IC: Octal Buffer/Line Driver/Line Receiver Low Power
IC22	SIT-74LS73	SN74LS73N	IC: Dual J-K Master-Slave Flip Flop Low Power
IC23	SIT-74LS04	SN74LS04N	IC: Hex Inverter Low Power
IC24	SIT-74LS74	SN74LS74N	IC: Dual D-Type Positive-Edge-Triggered Flip Flop with Preset AND Clear Low Power
IC25	SIT-74LS04	SN74LS04N	IC: Hex Inverter Low Power
IC26	SIT-74LS244	SN74LS244N	IC: Octal Buffer/Line Driver/Line Receiver Low Power
IC27	SIT-74LS393	SN74LS393N	IC: Dual 4-bit Binary Counter Low Power
IC28	SIT-74LS14	SN74LS14N	IC: Hex Schmitt-Triggered Inverter Low Power
IC29	SIT-74LS10	SN74LS10N	IC: Triple 3-Input Positive NAND Gate Low Power
IC30	SIT-74LS32	SN74LS32N	IC: Quadruple 2-Input Positive OR-Gate Low Power
IC31	SIT-74LS02	SN74LS02N	IC: Quadruple 2-Input Positive-NOR Gate Low Power
IC32	SIT-74LS273	SN74LS273N	IC: Octal D-Type Flip Flop Low Power
IC33	SIT-74LS374	SN74LS374N	IC: Octal D-Type Flip Flop Low Power
IC34	SIT-74LS244	SN74LS244N	IC: Octal Buffer/Line Driver/Line Receiver Low Power
IC35	SIA-311-1	LM311H	IC: Voltage Comparator
IC36	SIA-561	AD561JD	IC: Low Cost 10-bit Monolithic D/A Converter
IC37	SIA-311-1	LM311H	IC: Voltage Comparator
IC38	SIA-2525	HA2-2525-5	IC: Operational Amplifier
IC39	SIA-319-1	LM319H	IC: High Speed Dual Comparator

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC40	SIA-DG201-1	DG201BK	IC: Quad Monolithic SPST CMOS Analog Switch
IC41	SIA-311-1	LM311H	IC: Voltage Regulator
IC42	SIA-561	AD561JD	IC: Low Cost 10-bit Monolithic D/A Converter
IC43	SIA-356-1	FF356H	IC: Junction FET INPUT Type Operational Amplifier
IC44	SIA-2525	HA-2525-5	IC: Operational Amplifier
IC45	SIA-2525	HA-2525-5	IC: Operational Amplifier
IC46	SIA-319	LM319H	IC: High Speed Dual Comparator
IC47	SIT-74LS08	SN74LS08N	IC: Quadruple 2-Input Positive-AND Gate Low Power
IC48	SIT-74LS74-9	SN74LS74N	IC: Dual D-Type Edge-Triggered Flip Flop Low Power
Q51	SFM-IT1750-1	IT1750	FET Junction N-Channel
Q52	STN-2SC639-1	2SC639	Transistor SI NPN
Q53	SFT-A70-1	UPA70A	FET Junction N-Channel
Q54	STN-2SC639-1	2SC639	Transistor SI NPN
Q55	STP-2SA711-1	2SA711	Transistor SI PNP
Q56	SFM-IT1750-1	IT1750	FET Junction N-Channel
Q57	STN-2SC639-1	2SC639	Transistor SI NPN
Q58	SFT-A70-1	UPA70A	FET Junction N-Channel
Q59	STN 2SC639-1	2SC639	Transistor SI NPN
Q60	STP-2SA711-1	2SA711	Transistor SI PNP
Q61	SFM-IT1750-1	IT1750	FET Junction N-Channel
Q62	STP-2SA711-1	2SA711	Transistor SI PNP
Q63	SFT-A70-1	UPA70A	FET Junction N-Channel
Q64	STN-2SC639-1	2SC639	Transistor SI NPN
Q65	STP-2SA711-1	2SA711	Transistor SI PNP
D71	SDS-1SS97-1	1SS97	Diode SI
D72	SDS-1SS97-1	1SS97	Diode SI
D73 thru D76	SDS-1S953	1S953	Diode SI
D77	SDZ-H2-8	RD-2.4E	Zener Diode
D78	SDZ-H2-8	RD-2.4E	Zener Diode
D79	SDS-1SS97-1	1SS97	Diode SI
D80	SDS-1SS97-1	1SS97	Diode SI
D81	SDS-1S953-1	1S953	Diode SI
D82	SDS-1S953-1	1S953	Diode SI
D83	SDS-LD1-1	LD-1	Diode SI
D84 thru D87	SDS-1S953-1	1S953	Diode SI
D88	SDS-LD1-1	LD-1	Diode SI
D89 thru D92	SDS-1S953-1	1S953	Diode SI
D93	SDZ-D043-1	RD-4.3F	Zener Diode
D94	SDZ-D043-1	RD-4.3F	Zener Diode
D95	SDS-1SS101-1	1SS101	Diode SI
R101 thru R104	RCB-AH1K	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R105	RMF-AR1MFK-1	SN14K2E1MΩF	R: FXD Metal FLM 1MΩ ±1% 1/4W
R106	RMF-AR4R3KFK-1	SN14K2E4.3KΩF	R: FXD Metal FLM 4.3kΩ ±1% 1/4W
R107	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R108	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R109	RCB-AH47K-1	RD25S47KΩJ	R: FXD CAR 47kΩ ±5% 1/4W
R110	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R111	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R112	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R113	RCB-AH6R8K-1	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R114	RCB-AH33-1	RD25S33ΩJ	R: FXD CAR 33Ω ±5% 1/4W
R115	RCB-AH33-1	RD25S33ΩJ	R: FXD CAR 33Ω ±5% 1/4W
R116	RCB-AH6R8K-1	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R117	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R118	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R119	RCB-AH100K-1	RD25S100KΩJ	R: FXD CAR 100kΩ ±5% 1/4W
R120	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R121	RBA-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R122	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R123	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R124 thru R129	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R130	RCB-AH-1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R131	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R132	RBA-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R133	RCB-AH47K-1	RD25S47KΩJ	R: FXD CAR 47kΩ ±5% 1/4W
R134	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R135	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R136	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R137	RBA-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R138	RBA-AH47K-1	RD25S47KΩJ	R: FXD CAR 47kΩ ±5% 1/4W
R139	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R140	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R141	RCB-AH6R8K-1	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R142	RCB-AH33-1	RD25S33ΩJ	R: FXD CAR 33Ω ±5% 1/4W
R143	RCB-AH33-1	RD25S33ΩJ	R: FXD CAR 33Ω ±5% 1/4W
R144	RCB-AH6R8K-1	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R145	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R146	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R147	RCB-AH100K-1	RD25S100KΩJ	R: FXD CAR 100kΩ ±5% 1/4W
R148 thru R150	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R151	RCB AH6R8K-1	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R152	RCB-AH33-1	RD25S33ΩJ	R: FXD CAR 33Ω ±5% 1/4W
R153	RCB-AH33-1	RD25S33ΩJ	R: FXD CAR 33Ω ±5% 1/4W
R154	RCB-AH6R8K-1	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R155	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R156	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R157	RCB-AH100K-1	RD25S100KΩJ	R: FXD CAR 100kΩ ±5% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R158	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R159	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R160	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R161	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R162	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R163	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R164	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R165	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R166	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R167	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R168	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
VR175	RVR-CD5K-1	RJ6X5KΩ	R: VAR CERMET 5kΩ
VR176 thru VR178	RVR-BD20K-1	X6S20KΩ	R: VAR WW 20kΩ
VR179	RVR-BE20K-1	X6T20KΩ	R: VAR WW 20kΩ
VR180	RVR-BE2K-1	X6T2KΩ	R: VAR WW 2kΩ
VR181	RVR-BE50-1	X6T50Ω	R: VAR WW 50Ω
C191	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C192	CFM-AA2200PR1K-1	441N1003-222K	C: FXD Mylar 2200pF ±10% 100V
C193	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C194	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C195	CMC-AB47PR3K-4	DM10D470J3	C: FXD DIPPED MICA 47pF ±5% 300V
C196	CMC-AB5PR5K-6	DM10C050K5	C: FXD DIPPED MICA 5pF ±10% 500V
C197 thru C200	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.22μF +80, -20% 50V
C201	CFM-AA3300PR1K-1	441N1003-332K	C: FXD Mylar 3300pF ±10% 100V
C202	CFM-AA3300PR1K-1	441N1003-332K	C: FXD Mylar 3300pF ±10% 100V
C203	CMC-AB43PR3K-4	DM10D430J3	C: FXD DIPPED MICA 43pF ±5% 300V
C204	CMC-AB5PR5K-6	DM10C050K5	C: FXD DIPPED MICA 5pF ±10% 500V
C205	CMC-AB43PR3K-4	DM10D430J3	C: FXD DIPPED MICA 43pF ±5% 300V
C206	CMC-AB5PR5K-6	DM10C050K5	C: FXD DIPPED MICA 5pF ±10% 500V
C207	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C208	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C209	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10uF ±20% 16V
C210	CTA-AC10V16V-1	242M1602-106M	C: FXD ELECT TANTAL 10uF ±20% 16V
C211 thru C221	CTA-AC1U50V-1	242M5002-105M	C: FXD ELECT TANTAL 1μF ±20% 50V
C222 thru C225	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10uF ±20% 35V
C226 thru C236	CTA-AC1U50V-1	242M5002-105M	C: FXD ELECT TANTAL 1μF ±20% 50V
C237 thru C253	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C254	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C255	CSM-ACR022U50V-1	0.022UF50WV	C: FCD CER 0.022μF +80, -20% 50V
C256	CSM-AC330P50V-1	330PF50WV	C: FXD CER 330pF ±10% 50V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
L261	LCL-T00084-1	LT-3	L: FXD Coil
L262	LCL-B00376-1	TPF0410-331K	L: FXD Coil
L263	LCL-B00376-1	TPF0410-331K	L: FCD Coil
C281	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022µF +80, -20% 50V
C282	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022µF +80, -20% 50V
C283	CSM-AC330P50V-1	330PF50WV	C: FXD CER 330pF ±10% 50V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1 thru IC4	SMM-2114	UPD2114LC-5	IC: 1KW x 4-bit Static RAM
IC5	SIT-74LS174	SN74LS174N	IC: Hex D-Type Flip Flop Low Power
IC6	SIT-74LS174	SN74LS174N	IC: Hex D-Type Flip Flop Low Power
IC7	SIT-74LS273	SN74LS273N	IC: Octal D-Type Flip Flop Low Power
IC8	SIT-74LS174	SN74LS174N	IC: Hex D-Type Flip Flop Low Power
IC9	SIT-74LS00	SN74LS00N	IC: Quadruple 2-Input Positive NAND Gate Low Power
IC10 thru IC13	SMM-2114-6	HM4722114AP-2	IC: 1K bit Static RAM
IC14	SIT-74LS153	SN74LS153N	IC: Dual 4-Line to 1-Line Data Selector/Multiplexer Low Power
IC15	SIT-74LS153	SN74LS153N	IC: Dual 4-Line to 1-Line Data Selector/Multiplexer Low Power
IC16	SIT-74LS273	SN74LS273N	IC: Octal D-Type Flip Flop Low Power
IC17	SIT-74LS174	SN74LS174N	IC: Hex D-Type Flip Flop Low Power
IC18	SIT-74LS30	SN74LS30N	IC: 8-Input Positive-NAND Gate Low Power
IC19	SIT-74LS367	SN74LS367N	IC: Hex Bus Driver Low Power
IC20 thru IC22	SMM-2114-6	HM472114AP-2	IC: 1K bit Static RAM
IC23	SIT-74LS153	SN74LS153N	IC: Dual 4-Line to 1-Line Data Selector/Multiplexer Low Power
IC24	SIT-74LS153	SN74LS153N	IC: Dual 4-Line to 1-Line Data Selector/Multiplexer Low Power
IC25	SIT-74LS83	SN74LS83N	IC: 4-bit Binary Full Adder with Fast Carry Low Power
IC26	SIT-74LS86	SN74LS86N	IC: Quadruple 2-Input Exclusive OR-Gate Low Power
IC27	SIT-74LS83	SN74LS83N	IC: 4-bit Binary Full Adder with Fast Carry Low Power
IC28	SIT-74LS393	SN74LS393N	IC: Dual 4-bit Binary Counter Low Power
IC29	SIT-74LS367	SN74LS367N	IC: Hex Bus Low Driver Power
IC30	SMM-2114-6	HM472114AP-2	IC: 1K bit Static RAM
IC31	SMM-2114-6	HM472114AP-2	IC: 1K bit Static RAM
IC32	SIT-74LS153	SN74LS153N	IC: Dual 4-Line to 1-Line Data Selector/ Multiplexer Low Power
IC33	SIT-74LS273	SN74LS273N	IC: Octal D-Type Flip Flop Low Power
IC34	SIA-562-4	HI-562-5	IC: 12-bit High Speed Monolithic DA Converter
IC35	SIA-562-4	HI-562-5	IC: 12-bit High Speed Monolithic DA Converter
IC36	SIT-74LS73	SN74LS73N	IC: Dual J-K Flip Flop with Clear Low Power
IC37	SIT-74LS04	SN74LS04N	IC: Hex Inverter Low Power
IC38	SIT-74LS245	SN74LS245N	IC: Octal Bus Tranceiver Low Power
IC39	SIT-74LS245	SN74LS245N	IC: Octal Bus Tranceiver Low Power
IC40	SIT-74LS00	SN74LS00N	IC: Quadruple 2-Input Positive NAND Gate Low Power
IC41	SIT-74LS393	SN74LS393N	IC: Dual 4-bit Binary Counter Low Power
IC42	SMM-2716	MB8516	IC: 16K bit Memory
IC43	SIT-74LS04	SN74LS04N	IC: Hex Inverter Low Power
IC44	SIT-74LS14	SN74LS14N	IC: Hex Schmitt-Trigger Inverter Low Power
IC45	SIT-74LS14	SN74LS14N	IC: Hex Schmitt-Trigger Inverter Low Power

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC46	SIT-74LS374	SN74LS374N	IC: Octal D-Type Flip Flop Low Power
IC47	SIT-74LS00	SN74LSDON	IC: Quadruple 2-Input Positive NAND Gate Low Power
IC48	SIT-74LS393	SN74LS393N	IC: Dual 4-bit Binary Counter Low Power
IC49	SIT-74LS273	SN74LS273N	IC: Octal D-Type Flip Flop Low Power
IC50	SIA-2525-3	HA2-2525-5	IC: Operational Amplifier
IC51	SIA-356	LF356H	IC: Junction FET INPUT Type Operational Amplifier
IC52	SIA-2525-3	HA2-2525-5	IC: Operational Amplifier
IC53	SIT-74LS00	SN74LS00N	IC: Quadruple 2-Input Positive NAND Gate Low Power
Q61	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
D65	SDZ-1S2191-2	1S2192	Diode SI
R71 thru R76	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R77	RMF-AR680QFK-1	SN14K2E680ΩF	R: FXD Metal FLM 680Ω ±1% 1/4W
R78	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R79	RCB-AH1R2K-1	RD25S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/4W
R80	RMF-AR680QFK-1	SN14K2E680ΩF	R: FXD Metal FLM 680Ω ±1% 1/4W
R81	RMF-AR6R2KFK-1	SN14K2E6.2KΩF	R: FXD Metal FLM 6.2kΩ ±1% 1/4W
R82	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R83	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±1% 1/4W
R84	RMF-AR680QFK-1	SN14K2E680ΩF	R: FXD Metal FLM 680Ω ±1% 1/4W
R85	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
VR91	RVR-BE1K-1	X6T1KΩ	R: VAR WW 1kΩ
C95 thru C100	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C101	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C102	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C103	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C104	CMC-AB20PR5K-6	DM10C200K5	C: FXD DIPPED MICA 20pF ±10% 500V
C105	CMC-AB20PR5K-6	DM10C200K5	C: FXD DIPPED MICA 20pF ±10% 500V
C106	CCK-AB100U16V-1	16VB100	C: FXD ELECT 100μF 16V
C107 thru C112	CTA-AC1U50V-1	242M5002-105M	C: FXD ELECT TANTAL 1μF ±20% 50V
C113	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10μF ±20% 16V
C114	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10μF ±20% 16V
C115 thru C118	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10μF ±20% 35V
C119 thru C134	CTA-AC1U50V-1	242M5002-105M	C: FXD ELECT TANTAL 1μF ±20% 50V
C135 thru C155	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
L161	LCL-T00084-1	*	L: FXD Coil

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
L162	LCL-B00376-1	TPF0410-331K	L: FXD Coil
L163	LCL-B00376-1	TPF0410-331K	L: FXD Coil

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TR4172
DISPLAY CONTROL
BGP-010189

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1	SMB-82S100	N82S100F	IC: Bipolar Field Programable Gate Array
IC2	SIT-74LS10-9	SN74LS10N	IC: Triple 3-Input Positive-NAND Gate Low Power
IC3	SIT-74LS151	SN74LS151N	IC: 1-of-8 Data Selector/Multiplexer Low Power
IC4	SIT-74LS138-9	SN74LS138N	IC: 3-to-8 Line Decoder/Multiplexer Low Power
IC5	SIT-74LS04	SN74LS04N	IC: Hex Inverter Low Power
IC6	SIT-74LS00	SN74LS00N	IC: Quadruple 2-Input Positive NAND Gate Low Power
IC7	SIT-74LS04	SN74LS04N	IC: Hex Inverter Low Power
IC8	SIT-74LS74-9	SN74LS74N	IC: Dual D-Type Positive-Edge-Triggered Flip Flop with Preset AND Clear
IC9	SIT-74LS73	SN74LS73N	IC: Dual J-K Flip Flop with Clear Low Power
IC10	SIT-74LS20-9	SN74LS20N	IC: Dual 4-Input Positive-NAND Gate Low Power
IC11	SIT-74LS00	SN74LS00N	IC: Quadruple 2-Input Positive NAND Gate Low Power
IC12	SIT-74LS139-9	SN74LS139N	IC: Dual 2-to-4 Line Decoder/Multiplexer Low Power
IC13	SIT-74LS08-9	SN74LS08N	IC: Quadruple 2-Input Positive AND Gate Low Power
IC14	SIT-74LS273	SN74LS273N	IC: Octal D-Type Flip Flop Low Power
IC15	SIT-74LS04	SN74LS04N	IC: Hex Inverter Low Power
IC16	SIT-74LS00	SN74LS00N	IC: Quadruple 2-Input Positive NAND Gate Low Power
IC17	SIT-74LS00	SN74LS00N	IC: Quadruple 2-Input Positive NAND Gate Low Power
IC18	SIT-74LS14	SN74LS14N	IC: Hex Schmitt-Trigger Inverter Low Power
IC19	SIT-74390-9	SN74LS390N	IC: Dual Decade Counter Low Power
IC20	SIT-74LS73	SN74LS73N	IC: Dual J-K Flip Flop with Clear Low Power
IC21	SIT-74LS10-9	SN74LS10N	IC: Triple 3-Input Positive-NAND Gate Low Power
IC22	SIT-74LS125	SN74LS125N	IC: Quadruple Bus Buffer Gate with three state Output Low Power
IC23	SIT-74LS08-9	SN74LS08N	IC: Quadruple 2-Input Positive AND Gate Low Power
IC24	SIT-74LS240	SN74LS240N	IC: IC: Octal Buffer/Line Driver/Line Receiver Low Power
IC25	SIT-74LS32-9	SN74LS32N	IC: Quadruple 2-Input Positive-OR Gate Low Power
IC26	SIT-74LS02-9	SN74LS02N	IC: Quadruple 2-Input Positive-NOR Gate Low Power
IC27	SIT-74LS197-9	SN74LS197N	IC: Presetable Counter/Latch Low Power
IC28	SIT-74LS08-9	SN74LS08N	IC: Quadruple 2-Input Positive AND Gate Low Power
IC29	SIT-7473-9	SN7473N	IC: Dual J-K Flip Flop with Clear
IC30	SIT-74LS73	SN74LS73N	IC: Dual J-K Flip Flop with Clear Low Power
IC31	SIT-74LS73	SN74LS73N	IC: Dual J-K Flip Flop with Clear Low Power
IC32	SIT-74LS04	SN74LS04N	IC: Dual J-K Flip Flop with Clear Low Power
IC33	S T-74LS02-9	SN74LS02N	IC: Quadruple 2-Input Positive-NOR Gate Low Power
IC34	SIT-74S189	SN74S189	IC: 64-bit Random Access Memory Low Power
IC35	SIT-74LS393-9	SN74LS393N	IC: Dual 4-bit Binary Counter Low Power
IC36	SIT-74LS393-9	SN74LS393N	IC: Dual 4-bit Binary Counter Low Power
IC37	SIT-74LS197-9	SN74LS197N	IC: Presetable Counter/Latch Low Power

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC38	SIT-74LS74-9	SN74LS74N	IC: Dual D-Type Positive-Edge-Triggered Flip Flop with Preset AND Clear Low Power
IC39	SIT-74LS138-9	SN74LS138N	IC: 3-to-8 Line Decoder/Multiplexer Low Power
IC40	SIT-74LS73	SN74LS73N	IC: Dual J-K Flip Flop with Clear Low Power
IC41	SIT-74LS73	SN74LS73N	IC: Dual J-K Flip Flop with Clear Low Power
IC42	SIT-74LS00	SN74LS00N	IC: Quadruple 2-Input Positive NAND Gate Low Power
IC43	SIT-74LS04	SN74LS04N	IC: Hex Inverter Low Power
IC44	SMB-74S189EX-1	SN74S189N(EX)	IC: 64-bit Random Access Memory
IC45	SIT-74LS157-9	SN74LS157N	IC: Quad 2- to 1-Line Data Selector/Multiplexer Low Power
IC46	SIT-74LS244	SN74LS244N	IC: Octal Buffer/Line Driver/Line Receiver Low Power
IC47	SIT-74LS244	SN74LS244N	IC: Octal Buffer/Line Driver/Line Receiver Low Power
IC48	SIT-74LS00	SN74LS00N	IC: Quadruple 2-Input Positive NAND Gate Low Power
IC49	SIT-74LS00	SN74LS00N	IC: Quadruple 2-Input Positive NAND Gate Low Power
IC50	SIT-74LS04-9	SN74LS04N	IC: Hex Inverter Low Power
C51	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10µF ±20% 16V
C52	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10µF ±20% 16V
C53 thru C69	CTA-AC1U50V-1	242M5002-105M	C: FXD ELECT TANTAL 1µF ±20% 50V
C70 thru C87	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C88	CTA-AC1V50V-1	242M5002-105M	C: FXD ELECT TANTAL 1µF ±20% 50V
L91	LCL-T00084-1	LT-3	L: FXD Coil

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1	SIT-74LS32	SN74LS32N	IC: Quadruple 2-Input Positive-OR Gate Low Power
IC2	SIT-74LS04	SN74LLS04N	IC: Hex Inverter Low Power
IC3	SIT-74LS32	SN74LS32N	IC: Quadruple 2-Input Positive-OR Gate Low Power
IC4	SIT-74LS390	SN74LS390N	IC: Dual Decade Counter Low Power
IC5	SIT-74LS32	SN74LS32N	IC: Quadruple 2-Input Positive-OR Gate Low Power
IC6	SIT74LS00	SN74LS00N	IC: Quadruple 2-Input Positive NAND Gate Low Power
IC7	SIT-74LS08	SN74LS08N	IC: Quadruple 2-Input Positive AND Gate Low Power
IC8	SIT-74LS139	SN74LS139N	IC: Dual 2-to-4 Line Decoder/Multiplexer Low Power
IC9	SIT-74LS32	SN74LS32N	IC: Quadruple 2-Input Positive-OR Gate Low Power
IC10	SIT-74LS390	SN74LS390N	IC: Dual Decade Counter Low Power
IC11	SIT-74LS04	SN74LS04N	IC: Hex Inverter Low Power
IC12	SIT-75160-1	SN75160N	IC: Octal General-Purpose Interface Bus Transceiver
IC13	SIT-75161-1	SN75161N	IC: Octal General-Purpose Interface Bus Transceiver
IC14	SIT-74LS244	SN74LS244N	IC: Octal Buffer/Line Driver/Line Receiver Low Power
IC15	SIT-74LS02	SN74LS02N	IC: Quadruple 2-Input Positive-NOR Gate Low Power
IC16	SIT-74LS08	SN74LS08N	IC: Quadruple 2-Input Positive AND Gate Low Power
IC17	SIT-74LS02	SN74LS02N	IC: Quadruple 2-Input Positive-NOR Gate Low Power
IC18	SIT-74LS367	SN74LS367N	IC: Hex Bus Driver Low Power
IC19	SIM-8253-2	UPD8253C-5	IC: Programable Interval Timer
IC20	SIT-74LS157	SN74LS157	IC: Quad 2-to 1-Line Data Selector/Multiplexer Low Power
IC21	SIM-9914-2	TMS9914ANL	IC: General-Purpose Interface Bus Adapter
IC22	SIT-74LS14	SN74LS14N	IC: Hex Schmitt-Trigger Inverter Low Power
IC23	SIT-74LS02	SN74LS02N	IC: Quadruple 2-Input Positive-NOR Gate Low Power
IC24	SIT-74LS08	SN74LS08N	IC: Quadruple 2-Input Positive-AND Gate Low Power
IC25	SIT-74LS00	SN74LS00N	IC: Quadruple 2-Input Positive NAND Gate Low Power
IC26	SIT-74LS245	SN74LS245N	IC: Octal Bus Tranceiver Low Power
IC27	SIT-74LS157	SN74LS157N	IC: Quad 2-to 1-Line Data Selector/Multiplexer Low Power
IC28	SIT-74LS244	SN74LS244N	IC: Octal Buffer/Line Driver/Line Receiver Low Power
IC29	SIT-74LS367	SN74LS367N	IC: Hex Bus Driver Low Power
IC30	SIT-74LS08	SN74LS08N	IC: Quadruple 2-Input Positive-AND Gate Low Power
IC31	SIT-74LS08	SN74LS08N	IC: Quadruple 2-Input Positive-AND Gate Low Power
IC32	SIT-74LS04	SN74LS04N	IC: Hex Inverter Low Power
IC33	SIT-74LS32	SN74LS32N	IC: Quadruple 2-Input Positive-OR Gate Low Power

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC34	SIT-74LS245	SN74LS245N	IC: Octal Bus Tranceiver Low Power
IC35			Not assigned
IC36	SIT-74LS157	SN74LS157N	IC: Quad 2-to 1-Line Data Selector/Multiplexer Low Power
IC37	SIT-74LS138	SN74LS138N	IC: 3-to-8 Line Decoder/Multiplexer Low Power
IC38	SIT-74LS148	SN74LS148N	IC: 8-Line-to-3-Line Octal Priority Encoder Low Power
IC39	SIT-74LS148	SN74LS148N	IC: 8-Line-to-3-Line Octal Priority Encoder Low Power
IC40	SIT-74LS244	SN74LS244N	IC: Octal Buffer/Line Driver/Line Receiver Low Power
IC41	SIT-74LS138	SN74LS138N	IC: 3-to-8 Line Decoder/Multiplexer Low Power
IC42	SIT-74LS32	SN74LS32N	IC: Quadruple 2-Input Positive-OR Gate Low Power
IC43 thru IC46	SIT-74LS244	SN74LS244N	IC: Octal Buffer/Line Driver/Line Receiver Low Power
IC47	SIT-74LS138	SN74LS138N	IC: 3-to-8 Line Decoder/Multiplexer Low Power
R51 thru R56	RAY-AA4R7K4-1	TMR4-472	R: FXD COM 4.7kΩ
C61	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10µF ±20% 16V
C62	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10µF ±20% 16V
C63 thru C79	CTA-AC1U50V-2	244M5002-105M	C: FXD ELECT TANTAL 1µF ±20% 50V
C80 thru C102	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
L111	LCL-T00084-1	*	L: FXD Coil
S115	KSA-000273-1	7-171474-8	Switch
S116	KSA-000273-1	7-171474-8	Switch
J121	JCR-AF040PX02-1	HIF3F-40P-2.54DS	Connector
J122	JCP-AA003PX05-1	A-1103	Connector

TR4172
GPIB SWITCH
BLB-010206

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
SW1	KSA-000691-1	7-171474-7	Switch
CBL5	DCB-RS0920X01A-1	*	Cable

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Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1	SIM-Z80A-1	µPD780C/D-1	IC: 8 bit µCPU
IC2	SIT-74LS75-9	SN74LS75N	IC: 4-bit Bistable Latch Low Power
IC3	SIT-74LS75-9	SN74LS75N	IC: 4-bit Bistable Latch Low Power
IC4	SIT-74LS244-9	SN74LS244N	IC: Octal Buffer/Line Driver/Line Receiver
IC5	SMM-2764-5	MBM2764-25Z	IC: 64K UV Erasable PROM
IC6	SIT-74LS157-9	SN74LS157N	IC: Quad 2-to-1 Line Data Selector/Multiplexer Low Power
IC7	SIT-74LS157-9	SN74LS157N	IC: Quad 2-to-1 Line Data Selector/Multiplexer Low Power
IC8	SIT-74LS04-9	SN74LS04N	IC: Hex Inverter Low Power
IC9	SIT-74LS244-9	SN74LS244N	IC: Octal Buffer/Line Driver/Line Receiver Low Power
IC10	SIT-74LS08-9	SN74LS08N	IC: Quadruple 2-Input Positive-AND Gate Low Power
IC11	SIT-74LS138-9	SN74LS138N	IC: 3-to-8 Line Decoder/Multiplexer Low Power
IC12	SIT-74LS139-9	SN74LS139N	IC: Dual 2-to-4 Line Decoder/Multiplexer Low Power
IC13	SIT-74LS170-1	SN74LS170N	IC: 4-By-4 Register File Low Power
IC14	SMM-2764-5	MBM2764-25Z	IC: 64K UV Erasable PROM
IC15	SMM-4164B-3	MB8264-15P	IC: 64K bit Dynamic RAM
IC16	SMM-4164B-3	MB8264-15P	IC: 64K bit Dynamic RAM
IC17	SIT-74LS02-9	SN74LS02N	IC: Quadruple 2-Input Positive-NOR Gate Low Power
IC18	SIT-74LS74-9	SN74LS74N	IC: Dual D-Type Positive-Edge-Triggered Flip Flop with Preset AND Clear Low Power
IC19	SIT-74LS32-9	SN74LS32N	IC: Quadruple 2-Input Positive-OR Gate Low Power
IC20	SIT-74LS32-9	SN74LS32N	IC: Quadruple 2-Input Positive-OR Gate Low Power
IC21	SMM-2764-5	MBM2764-25Z	IC: 64K UV Erasable PROM
IC22	SMM-4164B-3	MB8264-15P	IC: 64K bit Dynamic RAM
IC23	SMM-4164B-3	MB8264-15P	IC: 64K bit Dynamic RAM
IC24	SIT-74LS14-9	SN74LS14N	IC: Hex Schmitt-Trigger Inverter Low Power
IC25	SIT-74LS00-9	SN74LS00N	IC: Quadruple 2-Input Positive NAND Gate Low Power
IC26	SIT-74LS74-9	SN74LS74N	IC: Dual D-Type Positive-Edge-Triggered Flip Flop with Preset AND Clear Low Power
IC27	SIT-74LS08-9	SN74LS08N	IC: Quadruple 2-Input Positive AND Gate Low Power
IC28	SIT-74LS04-9	SN74LS04N	IC: Hex Inverter Low Power
IC29	SMM-4164B-3	MB8264-15P	IC: 64K bit Dynamic RAM
IC30	SMM-4164B-3	MB8264-15P	IC: 64K bit Dynamic RAM
IC31	SIT-74LS393-9	SN74LS393N	IC: Dual 4-bit Binary Counter Low Power
IC32	SIT-74LS32-9	SN74LS32N	IC: Quadruple 2-Input Positive AND Gate Low Power
IC33	SIT-74LS157-9	SN74LS157N	IC: Quad 2-to-1 Line Data Selector/Multiplexer Low Power
IC34	SIT-74LS244-9	SN74LS244N	IC: Octal Buffer/Line Driver/Line Receiver Low Power
IC35	SIT-74LS10-9	SN74LS10N	IC: Triple 3-Input Positive-NAND Gate Low Power
IC36	SMM-4164B-3	MB8264-15P	IC: 64K bit Dynamic RAM
IC37	SMM-4164B-3	MB8264-15P	IC: 64K bit Dynamic RAM

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC38	SIT-74LS14-9	SN74LS14N	IC: Hex Schmitt-Trigger Inverter Low Power
IC39	SIT-74LS14-9	SN74LS14N	IC: Hex Schmitt-Trigger Inverter Low Power
IC40	SIT-74LSD08-9	SN74LS08N	IC: Quadruple 2-Input Positive AND Gate Low Power
IC41	SIT-74LS244-9	SN74LS244N	IC: Octal Buffer/Line Driver/Line Receiver Low Power
IC42 thru IC44	SIT-74LS245-9	SN74LS245N	IC: Octal Bus Tranceiver Low Power
IC45	SIT-74LS157-9	SN74LS157N	IC: Quadruple 2-Line-to-1 Data Selector Multiplexer Low Power
IC46	SIT-74LS00-9	SN74LS00N	IC: Quadruple 2-Input Positive-NAND Gate Low Power
IC47	SIT-74LS244-9	SN74LS244N	IC: Octal Buffer/Line Driver/Line Receiver Low Power
	JCI-AK040JX01-1	DILBQ40P-101	IC Socket
Q51	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q52 thru Q54	STP-2SA1015-1	2SA1015	Transistor SI PNP
Q55 thru Q57	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
D61	SDS-1S953-1	1S953	Diode SI
D62 thru D66			Not assigned
D67 thru D72	NLD-000016-1	SLP-114B	Light Emitting Diode
R81	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R82	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R83	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R84	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R85	RCB-AH100K-1	RD25S100KΩJ	R: FXD CAR 100kΩ ±5% 1/4W
R86	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R87	RCB-AH12K-1	RD25S12KΩJ	R: FXD CAR 12kΩ ±5% 1/4W
R88	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R89	RCB-AH3R9K-1	RD25S3.9KΩJ	R: FXD CAR 3.9kΩ ±5% 1/4W
R90	RCB-AH820-1	RD25S820ΩJ	R: FXD CAR 820Ω ±5% 1/4W
R91	RCB-AH1R2K-1	RD25S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/4W
R92	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R93	RCB-AH22-1	RD25S22ΩJ	R: FXD CAR 22Ω ±5% 1/4W
R94	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R95	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R96	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R97	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R98	RCB-AH4R7K-1	RC25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R99	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R100	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R101	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R102	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R103	RAY-AA4R7K6-1	TMR6-472	R: FXD COM 4.7kΩ
R104	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R105	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R106	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R107	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R108			Not assigned
R109	RAY-AA680Q6-1	TMR6-681	R: FXD COM 680Ω
R110 thru R112	RAY-AA4R7K4-1	TMR4-472	R: FXD COM 4.7kΩ
R113	RCB-AH330	RD25S330ΩJ	R: FXD CAR 330Ω ±5% 1/4W
R114	RCB-AH680	RD25S680ΩJ	R: FXD CAR 680Ω ±5% 1/4W
R115 thru R117	RAY-AA4R7K4-1	TMR4-472	R: FXD COM 4.7kΩ
C121	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C122	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C123	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C124	CSM-AC22P50V-1	22PF50WV	C: FXD CER 22pF ±10% 50V
C125	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C126	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C127	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C128	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C129 thru C131			Not assigned
C132	CCK-AB47U10V-1	10VB47	C: FXD ELECT 47μF 10V
C133	CCK-AB10U16V-1	16VB10	C: FXD ELECT 10μF 16V
C134	CCK-AB1U50V-1	50VB1	C: FXD ELECT 1μF 50V
C135	CCK-AB22U16V-1	16VB22	C: FXD ELECT 22μF 16V
C136	CCK-AB22U16V-1	16VB22	C: FXD ELECT 22μF 16V
C137	CCK-AB10U16V-1	16VB10	C: FXD ELECT 10μF 16V
C138 thru C141			Not assigned
C142	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10μF 25V
C143	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10μF 25V
C144 thru C150			Not assigned
C151 thru C169	CCK-ANR33U16V-1	CA92E-1C-R3300-R54C	C: FXD ELECT 0.33μF 16V
C170 thru C193	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C194	CCK-AB22U10V-1	10VB22	C: FXD ELECT 22μF 10V
L201	LCL-T00084-1	*	L: FXD Coil
L202	LCL-T00084-1	*	L: FXD Coil
L203			Not assigned
X211	DXC-000109	CX0-024-02	Crystal

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
S215	KSE-000453-1	KHC15901	Switch
FL221	DNF-000199-2	SFE10.0MA-M	Filter
DL223	DDL-AC10-1	DC-10-20	Delay Line
J225			Not assigned
C230 thru C236	CCK-ANR33U16V-1	CA92E-1C-R3300-R54C	C: FXD ELECT 0.33μF ±0.25% 16V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1 thru IC3	SMM-2764-5	MBM2764-25Z	IC: 64K UV Erasable PROM
IC4	SIT-74LS244	SN74LS244N	IC: Octal Buffer/Line Driver/Line Receiver Low Power
IC5	SIT-74LS390	SN74LS390N	IC: DUAL Decade Counter Low Power
IC6	SIA-393-1	LM393	IC: Low Power Low Drift
IC7 thru IC9	SMM-2764-5	MBM2764-25Z	IC: 64K UV Erasable PROM
IC10	SIT-74LS157	SN74LS157N	IC: Quad 2-to-1-Line Data Selector/Multiplexer Low Power
IC11	SIT-74LS74-9	SN74LS74N	IC: Dual D-type Positive-Edge-Triggered Flip Flop with Preset AND Clear Low Power
IC12	SIT-74LS04	SN74LS04N	IC: Hex Inverter Low Power
IC13	SIM-8279-5	UPD8279C-5	IC: Programable Key Boad/Display Controller
IC14	SIT-74LS08-9	SN74LS08N	IC: Quadruple 2-Input Positive-AND Gate Low Power
IC15	SIT-74LS12-9	SN74LS12N	IC: Triple 3-Input Positive-NAND Gate with Open-Collector Output Low Power
IC16	SIT-74LS08-9	SN74LS08N	IC: Quadruple 2-Input Positive-AND Gate Low Power
IC17	SIT-74LS32-9	SN74LS32N	IC: Quadruple 2-Input Positive-OR Gate Low Power
IC18	SMM-2764-5	MBM2764-25Z	IC: 64K UV Erasable PROM
IC19	SMM-2764-5	MBM2764-25Z	IC: 64K UV Erasable PROM
IC20	SIT-74LS04	SN74LS04N	IC: Hex Inverter
IC21	SIT-74LS32-9	SN74LS32N	IC: Quadruple 2-Input Positive-OR Gate Low Power
IC22	SIT-74LS123-9	SN74LS123N	IC: Retriggerable Monostable Multivibrator with Clear Low Power
IC23	SIT-74LS00	SN74LS00N	IC: Quadruple 2-Input Positive-NAND Gate Low Power
IC24	SIT-74LS138-9	SN74LS138N	IC: 3-to-8 Line Decoder/Multiplexer Low Power
IC25	SIT-74LS32-9	SN74LS32N	IC: Quadruple 2-Input Positive-OR Gate Low Power
IC26	SMM-4164B-5	HM6264LP-15	IC: 64K bit High Speed Static CMOS RAM
IC27			Not assigned
IC28	SIT-74LS10	SN74LS10N	IC: Triple 3-Input Positive-NAND Gate Low Power
IC29	SIT-74LS170	SN74LS170N	IC: 4-By-4 Register File Low Power
IC30	SIT-74LS123-9	SN74LS123N	IC: Retriggerable Monostable Multivibrator with Clear Low Power
IC31	SIT-74LS00	SN74LS00N	IC: Quadruple 2-Input Positive NAND Gate Low Power
IC32	SIT-74LS244	SN74LS244N	IC: Octal Buffer/Line Driver/Line Receiver Low Power
IC33	SIT-74LS04	SN74LS04N	IC: Hex Inverter Low Power
IC34	SIT-A57-1	UPA57C	IC: Darington Transister Array
IC35	SIT-74LS138-9	SN74LS138N	IC: 3-to-8 Line Decoder/Multiplexer Low Power
IC36	SIT-74LS75	SN74LS75N	IC: 4-bit Bistable Latch Low Power
IC37	SIT-74LS12	SN74LS12N	IC: Triple 3-Input Positive-NAND Gate with Open-Collector Output Low Power
IC38	SIT-74LS245-9	SN74LS245N	IC: Octal Bus Tranceiver Low Power

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC39	SIT-74LS244	SN74LS244N	IC: Octal Buffer/Line Driver/Line Receiver Low Power
IC40	SIT-74LS244	SN74LS244N	IC: Octal Bus Tranceiver Low Power
IC41	SIT-74LS14-9	SN74LS14N	IC: Hex Schmitt-Trigger Inverter Low Power
IC42	SIT-74LS04	SN74LS04N	IC: Hex Inverter Low Power
IC43	SIT-A57-1	UPA57C	IC: Darington Tansister Array
IC44	SIT-74LS30	SN74LS30N	IC: 8-Input NAND Gate Low Power
IC45	SIT-74LS244	SN74LS244N	IC: Octal Bus Tranceiver Low Power
IC46	SIT-74LS00	SN74LS00N	IC: Quadruple 2-Input NAND Gate Low Power
IC47	SIT-74LS08	SN74LS08N	IC: Quadruple 2-Input AND Gate Low Power
	JCI-AD024JX01-2	DL2-24A	IC Socket
Q51 thru Q58	STP-2SA642-3	2SA952	Transistor SI PNP
Q59	STN-2SC1815-15	28C1815GR	Transistor SI NPN
Q60	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q61	STP-2SA1015-1	2SA1015	Transistro SI PNP
Q62	STP-2SA1015-1	2SA1015	Transistor SI PNP
D65	SDS-1S953	1S953	Diode SI
D66			Not assigned
D67			Not assigned
R71	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R72	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R73	RCB-AH22K-1	RD25S22KΩJ	R: FXD CAR 22kΩ ±5% 1/4W
R74	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R75	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R76	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R77	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R78	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R79	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R80	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R81	RCB-AH8R2K	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R82	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R83	RCB-AH33K-1	RD25S33KΩJ	R: FXD CAR 33kΩ ±5% 1/4W
R84	RCB-AH8R2K	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R85	RCB-AH5R6K	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R86	RCB-AH27K-1	RD25S27KΩJ	R: FXD CAR 27kΩ ±5% 1/4W
R87	RCB-AH5R6K-1	RD25S5R6KΩJ	R: FXD CAR 5.6KΩ ±5% 1/4W
R88 thru R90	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R91	RCB-AH4R7K-1	RD25S4.7KΩM	R: FXD CAR 4.7kΩ ±5% 1/4W
R92 thru R99	RCB-AH47-1	RD25S47ΩJ	R: FXD CAR 47Ω ±5% 1/4W
R100 thru R107	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R108	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R109	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R110	RAY-AA10K6-1	TMR6-103	R: FXD COM 10kΩ
R111	RCB-AH15K-1	RD25S15KΩJ	R: FXD CAR 15kΩ ±5% 1/4W
R112	RCB-AH1R5K-1	RD25S1.5KΩJ	R: FXD CAR 1.5kΩ ±5% 1/4W
R113	RAY-AA4R7K4-1	TMR4-472	R: FXD COM 4.7kΩ
R114	RCB-AH1K	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R115	RCB-AH330-1	RD25S330ΩJ	R: FXD CAR 330Ω ±5% 1/4W
R116	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R117 thru R120	RAY-AA4R7K4-1	TMR4-472	R: FXD COM 4.7kΩ
R121	RCB-AH22K-1	RD25S22KΩJ	R: FXD CAR 22kΩ ±5% 1/4W
R122	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R123	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R124			Not assigned
R125	RVR-CD10K-2	3321N-1-103	R: VAR CERMET 10kΩ
R126	RVR-CD10K-2	3321N-1-103	R: VAR CERMET 10kΩ
R127			Not assigned
R128			Not assigned
R129	RAY-AA10K6-1	TMR6-103	R: FXD COM 10kΩ
C131	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C132	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C133	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C134	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C135 thru C142	CCK-AB10U16V	16VB10	C: FXD ELECT 10μF 16V
C143 thru C158	CCK-ANR33U16V	CA92E-1C-R3300-R54C	C: FXD ELECT 0.33μF ±0.25% 16V
C159 thru C175	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C176 thru C178			Not assigned
L181	LCL-T00084-1	*	L: FXD Coil
L182	LCL-T00084-1	*	L: FXD Coil
J185	JCR-AF040PX02-1	HIF3F-40P-2.54DS	Connector
J186 thru J188			Not assigned

FW

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
D1 thru D29	NLD-000003-1	BR3402S	Light Emitting Diode
R33	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R34	RCB-AH150-1	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R35	RCB-AH150-1	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
J38	JCR-AF040PX01-1	HIF4F-40P-2.54DSA	Connector
S41 thru S97	KSP-000250-1	1KSR001-00081-000	Push Switch

TR4172
IF BLOCK
MEP-338

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
J11 thru J13	JCF-AC001JX02-2	UM-QR	Connector
J14	JCF-AB001JX11-2	3CR	Connector

ff

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1 thru IC5	SIA-324-1	LM324	IC: Quadruple Operational Amplifier
Q11	STN-2SC1254	2SC1254	Transistor SI NPN
Q12	STP-2SA1015	2SA1015	Transistor SI PNP
Q13	STN-2SC1254	2SC1254	Transistor SI NPN
Q14	STP-2SA1015	2SA1015	Transistor SI NPN
Q15	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q16	STP-2SA1015	2SA1015	Transistor SI PNP
Q17	SFN-2SK33	2SK33F	FET Junction N-Channel
Q18	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q19	SFN-2SK33	2SK33F	FET Junction N-Channel
Q20	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q21	SFN-2SK33	2SK33F	FET Junction N-Channel
Q22	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q23	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q24	STP-2SA1015	2SA1015	Transistor SI PNP
Q25	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q26	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q27	SFN-2SK33	2SK33F	FET Junction N-Channel
Q28	STP-2SA1015	2SA1015	Transistor SI PNP
Q29	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q30	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q31	SFN-2SK33	2SK33F	FET Junction N-Channel
Q32	STP-2SA1015	2SA1015	Transistor SI PNP
Q33	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q34	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q35	SFN-2SK33	2SK33F	FET Junction N-Channel
Q36	STP-2SA1015	2SA1015	Transistor SI PNP
Q37	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q38	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q39	SFN-2SK33	2SK33F	FET Junction N-Channel
Q40	STP-2SA1015	2SA1015	Transistor SI PNP
D51	SDS-1S953	1S953	Diode SI
D52	SDS-1S953	1S953	Diode SI
D53 thru D110	SDS-1S2222	1S2222	Diode SI
D111 thru D114			Not assigned
D115 thru D118	SDS-1S2222	1S2222	Diode SI
R121	RCB-AH51	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R122	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R123	RCB-AH4R7K	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R124	RCB-AH470	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R125	RCB-AH820	RD25S820ΩJ	R: FXD CAR 820Ω ±5% 1/4W
R126	RCB-AH680-1	RD25S680ΩJ	R: FXD CAR 680Ω ±5% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R127	RVR-BE200	X6T200Ω	R: VAR WW 200Ω
R128	RCB-AH100	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R129	RCB-AH1K	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R130	RCB-AH4R7K	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R131	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R132	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R133	RCB-AH820	RD25S820ΩJ	R: FXD CAR 820Ω ±5% 1/4W
R134	RCB-AH180-1	RD25S180ΩJ	R: FXD CAR 180Ω ±5% 1/4W
R135	RCB-AH39	RD25S39ΩJ	R: FXD CAR 39Ω ±5% 1/4W
R136	RVR-BE100	X6T100Ω	R: VAR WW 100Ω
R137	RVR-BE20	X6T20Ω	R: VAR WW 20Ω
R138	RCB-AH6R8K	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R139	RCB-AH6R8K	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R140	RCB-AH1K	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R141	RCB-AH100	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R142	RCB-AH10	RD25S10ΩJ	R: FXD CAR 10Ω ±5% 1/4W
R143	RCB-AH10	RD25S10ΩJ	R: FXD CAR 10Ω ±5% 1/4W
R144	RCB-AH100	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R145	RCB-AH12K	RD25S12KΩJ	R: FXD CAR 12kΩ ±5% 1/4W
R146	RCB-AH2R2K	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R147			Not assigned
R148			Not assigned
R149	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R150	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R151	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R152	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R153	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R154	RCB-AH1R2K	RD25S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/4W
R155	RCB-AH390	RD25S390ΩJ	R: FXD CAR 390Ω ±5% 1/4W
R156	RCB-AH270	RD25S270ΩJ	R: FXD CAR 270Ω ±5% 1/4W
R157	RCB-AH82	RD25S82ΩJ	R: FXD CAR 82Ω ±5% 1/4W
R158 thru R161	RCB-AH5R6K	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R162 thru R165	RCB-AH2R2K	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R166	RCB-AH120	RD25S120ΩJ	R: FXD CAR 120Ω ±5% 1/4W
R167	RCB-AH750-1	RD25S750ΩJ	R: FXD CAR 750Ω ±5% 1/4W
R168	RCB-AH560	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R169	RCB-AH560	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R170	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R171	RCB-AH8R2K	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R172	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R173	RCB-AH1R2K	RD25S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/4W
R174	RCB-AH390	RD25S390ΩJ	R: FXD CAR 390Ω ±5% 1/4W
R175	RCB-AH270	RD25S270ΩJ	R: FXD CAR 270Ω ±5% 1/4W
R176	RCB-AH82	RD25S82ΩJ	R: FXD CAR 82Ω ±5% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R177 thru R180	RCB-AH5R6K	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R181 thru R184	RCB-AH2R2K	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R185	RCB-AH120	RD25S120ΩJ	R: FXD CAR 120Ω ±5% 1/4W
R186	RCB-AH750	RD25S750ΩJ	R: FXD CAR 750Ω ±5% 1/4W
R187	RCB-AH560	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R188	RCB-AH560	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R189	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R190	RCB-AH8R2K	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R191	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R192	RCB-AH1R2K	RD25S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/4W
R193	RCB-AH390	RD25S390ΩJ	R: FXD CAR 390Ω ±5% 1/4W
R194	RCB-AH270	RD25S270ΩJ	R: FXD CAR 270Ω ±5% 1/4W
R195	RCB-AH82	RD25S82ΩJ	R: FXD CAR 82Ω ±5% 1/4W
R196 thru R199	RCB-AH5R6K	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R200 thru R203	RCB-AH2R2K	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R204	RCB-AH120	RD25S120ΩJ	R: FXD CAR 120Ω ±5% 1/4W
R205	RVR-BE100	X6T100Ω	R: VAR WW 100Ω
R206	RCB-AH680	RD25S680ΩJ	R: FXD CAR 680Ω ±5% 1/4W
R207	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R208	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R209	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R210	RCB-AH8R2K	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R211	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R212	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R213	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R214	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R215	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R216	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R217	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R218	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R219	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R220	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R221	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R222	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R223	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R224	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R225	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R226	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R227	RCB-AH51	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R228	RCB-AH220	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R229	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R230	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R231	RCB-AH150	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R232	RCB-AH10	RD25S10ΩJ	R: FXD CAR 10Ω ±5% 1/4W
R233	RCB-AH33	RD25S33ΩJ	R: FXD CAR 33Ω ±5% 1/4W
R234	RCB-AH150	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R235	RVR-BE100	X6T100Ω	R: VAR WW 100Ω
R236	RCB-AH100	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R237	RCB-AH8R2K	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R238	RCB-AH2R2K	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R239	RCB-AH820	RD25S820ΩJ	R: FXD CAR 820Ω ±5% 1/4W
R240	RCB-AH470	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R241	RCB-AH6R8K	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R242	RCB-AH1R2K	RD25S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/4W
R243	RCB-AH560	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R244	RCB-AH390	RD25S390ΩJ	R: FXD CAR 390Ω ±5% 1/4W
R245	RCB-AH100	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R246	RCB-AH39	RD25S39ΩJ	R: FXD CAR 39Ω ±5% 1/4W
R247 thru R249	RCB-AH5R6K	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R250 thru R252	RCB-AH2R2K	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R253 thru R255	RCB-AH5R6K	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R256 thru R258	RCB-AH2R2K	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R259	RCB-AH33K	RD25S33KΩJ	R: FXD CAR 33kΩ ±5% 1/4W
R260	RCB-AH33K	RD25S33KΩJ	R: FXD CAR 33kΩ ±5% 1/4W
R261	RCB-AH150	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R262	RCB-AH51	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R263	RCB-AH10	RD25S10ΩJ	R: FXD CAR 10Ω ±5% 1/4W
R264	RCB-AH100	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R265	RCB-AH8R2K	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R266	RCB-AH2R2K	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R267	RCB-AH820	RD25S820ΩJ	R: FXD CAR 820Ω ±5% 1/4W
R268	RCB-AH470	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R269	RCB-AH6R8K	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R270	RCB-AH1R2K	RD25S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/4W
R271	RCB-AH560	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R272	RCB-AH390	RD25S390ΩJ	R: FXD CAR 390Ω ±5% 1/4W
R273	RCB-AH100	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R274	RCB-AH39	RD25S39ΩJ	R: FXD CAR 39Ω ±5% 1/4W
R275 thru R280	RCB-AH5R6K	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R281 thru R286	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2KΩ ±5% 1/4W
R287	RCB-AH33K	RD25S33KΩJ	R: FXD CAR 33KΩ ±5% 1/4W
R288	RCB-AH33K	RD25S33KΩJ	R: FXD CAR 33kΩ ±5% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R289	RCB-AH150	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R290	RCB-AH51	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R291	RCB-AH10	RD25S10ΩJ	R: FXD CAR 10Ω ±5% 1/4W
R292	RCB-AH100	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R293	RCB-AH8R2K	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R294	RCB-AH2R2K	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R295	RCB-AH820	RD25S820ΩJ	R: FXD CAR 820Ω ±5% 1/4W
R296	RCB-AH470	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R297	RCB-AH6R8K	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R298	RCB-AH1R2K	RD25S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/4W
R299	RCB-AH560	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R300	RCB-AH390	RD25S390ΩJ	R: FXD CAR 390Ω ±5% 1/4W
R301	RCB-AH100	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R302	RCB-AH39	RD25S39ΩJ	R: FXD CAR 39Ω ±5% 1/4W
R303 thru R308	RCB-AH5R6K	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R309 thru R314	RCB-AH2R2K	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R315	RCB-AH33K	RD25S33KΩJ	R: FXD CAR 33kΩ ±5% 1/4W
R316	RCB-AH33K	RD25S33KΩJ	R: FXD CAR 33kΩ ±5% 1/4W
R317	RCB-AH51	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R318	RCB-AH10	RD25S10ΩJ	R: FXD CAR 10Ω ±5% 1/4W
R319	RVR-BE20	X6T20Ω	R: VAR WW 20Ω
R320	RCB-AH100	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R321	RCB-AH8R2K	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R322	RCB-AH2R2K	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R323	RCB-AH820	RD25S820ΩJ	R: FXD CAR 820Ω ±5% 1/4W
R324	RCB-AH470	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R325	RCB-AH6R8K	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R326	RCB-AH1R2K	RD25S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/4W
R327	RCB-AH560	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R328	RCB-AH390	RD25S390ΩJ	R: FXD CAR 390Ω ±5% 1/4W
R329	RCB-AH100	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R330	RCB-AH39	RD25S39ΩJ	R: FXD CAR 39Ω ±5% 1/4W
R331 thru R336	RCB-AH5R6K	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R337 thru R342	RCB-AH2R2K	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R343	RCB-AH47K	RD25S47KΩJ	F: FXD CAR 47kΩ ±5% 1/4W
R344	RCB-AH47K	RD25S47KΩJ	R: FXD CAR 47kΩ ±5% 1/4W
R345	RCB-AH150	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R346	RCB-AK220	RD50S220ΩJ	R: FXD CAR 220Ω ±5% 1/2W
R347	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R348	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R349	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R350	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R351	RCB-AH150	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R352 thru R357			Not assigned
R358 thru R361	RCB-AH10	RD25S10ΩJ	R: FXD CAR 10Ω ±5% 1/4W
R362	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R363	RVR-BE100-1	X6T100Ω	R: VAR WW 100Ω
C371	CMC-AB330PR3K-4	DM10D331J3	C: FXD DIPPED MICA 330pF ±5% 300V
C372	CMC-AB33PR5K-4	DM10D330J5	C: FXD DIPPED MICA 33pF ±5% 500V
C373			Not assigned
C374	CMC-AC510PR3K-2	DM15D511J3	C: FXD DIPPED MICA 510pF ±5% 300V
C375	CMC-AB33PR5K-4	DM10D330J5	C: FXD DIPPED MICA 33pF ±5% 500V
C376			Not assigned
C377	CMC-AB270PR3K-4	DM10D271J3	C: FXD DIPPED MICA 270pF ±5% 300V
C378 thru C380			Not assigned
C381	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C382	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047uF +80, -20% 50V
C383	CSM-AC15P50V	15PF50WV	C: FXD CER 15pF ±10% 50V
C384	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C385	CTA-AB10U35V	221M3502-106M	C: FXD ELECT TANTAL 10uF ±20% 35V
C386	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C387	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047uF +80, -20% 50V
C388	CSM-AC15P50V	15PF50WV	C: FXD CER 15pF ±10% 50V
C389 thru C392	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C393	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047uF +80, -20% 50V
C394	CTA-AB10U35V	221M3502-106M	C: FXD ELECT TANTAL 10Ω ±20% 35V
C395	CTA-AB10U35V	221M3502-106M	C: FXD ELECT TANTAL 10u ±20% 35V
C396 thru C403	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C404	CCK-AA100U25V	25T100	C: FXD ELECT 100uF 25V
C405	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C406 thru C408	CCK-AA100U25V	25T100	C: FXD ELECT 100uF 25V
C409	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C410	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047uF +80, -20% 50V
C411 thru C420	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C421	CFM-AL2000P-3	CQ08S2B-20000-J02	C: FXD Styrol 2000pF
C422	CTM-AC20P	ECV1ZW20X32	C: VAR CER 20pF
C423	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C424	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C425	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047uF +80, -20% 50V
C426	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C427	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047uF +80, -20% 50V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C428 thru C436	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C437	CFM-AL2000P-3	CQ08S2B-20000-J02	C: FXD Styrol 2000pF
C438	CTM-AC20P	ECV1ZW20X32	C: VAR CER 20pF
C439	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C440	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C441	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047µF +80, -20% 50V
C442	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C443	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047µF +80, -20% 50V
C444 thru C452	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C453	CFM-AL2000P-3	CQ08S2B-20000-J02	C: FXD Styrol 2000pF
C454	CTM-AC20P	ECV1ZW20X32	C: VAR CER 20pF
C455	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C456	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C457	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047µF +80, -20% 50V
C458	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C459	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047µF +80, -20% 50V
C460	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C461	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047µF +80, -20% 50V
C462 thru C464	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C465	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047µF +80, -20% 50V
C466	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C467	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C468	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047µF +80, -20% 50V
C469 thru C471	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C472	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047µF +80, -20% 50V
C473 thru C477	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C478	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047µF +80, -20% 50V
C479	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C480	CMC-AB10PR5K-4	DM10D100J5	C: FXD DIPPED MICA 10pF ±5% 500V
C481			Not assigned
C482	CTM-AC6P	ECV1ZW06X32	C: VAR CER 6pF
C483	CMC-AB47PR3K-4	DM10D470J3	C: FXD DIPPED MICA 47pF ±5% 300V
C484	CTM-AC20P	ECV1ZW20X32	C: VAR CER 20pF
C485			Not assigned
C486	CSM-AB27P50V-6	CC45UJ1H270KY	C: FXD CER 27pF ±10% 50V
C487 thru C500	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C501	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047µF +80, -20% 50V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C502	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C503	CMC-AB10PR5K-4	DM10D100J5	C: FXD DIPPED MICA 10pF ±5% 500V
C504			Not assigned
C505	CTM-AC6P	ECV1ZW06X32	C: VAR CER 6pF
C506	CTM-AC20P	ECV1ZW20X32	C: VAR CER 20pF
C507	CMC-AB47PR3K-4	DM10D470J3	C: FXD DIPPED MICA 47pF ±5% 300V
C508			Not assigned
C509	CSM-AB27P50V-6	CC45UJ1H270KY	C: FXD CER 27pF ±10% 50V
C510 thru C522	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C523	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C524	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C525	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C526	CMC-AB10PR5K-4	DM10D100J5	C: FXD DIPPED MICA 10pF ±5% 500V
C527			Not assigned
C528	CTM-AC6P	ECV1ZW06X32	C: VAR CER 6pF
C529	CTM-AC20P	ECV1ZW20X32	C: VAR CER 20pF
C530	CMC-AB47PR3K-4	DM10D470J3	C: FXD DIPPED MICA 47pF ±5% 300V
C531			
C532	CSM-AB27P50V-6	CC45UJ1H270KY	C: FXD CER 27pF ±10% 50V
C533 thru C545	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C546	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C547	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C548	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C549	CMC-AB10PR5K-4	DM10D100J5	C: FXD DIPPED MICA 10pF ±5% 500V
C550			Not assigned
C551	CTM-AC6P	ECV1ZW06X32	C: VAR CER 6pF
C552	CTM-AC20P	ECV1ZW20X32	C: VAR CER 20pF
C553	CMC-AB47PR3K-4	DM10D470J3	C: FXD DIPPED MICA 47pF ±5% 300V
C554			Not assigned
C555	CSM-AB27P50V-6	CC45UJ1H270KY	C: FXD CER 27pF ±10% 50V
C556 thru C568	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C569	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C570	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C571	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C572	CSM-ACR01U50V	0.01UF50WV	C: FXd CER 0.01μF +80, -20% 50V
C573	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C574 thru C577			Not assigned
C578 thru C581	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C582 thru C585	CSM-AC22P50V-1	22PF50WV	C: FXD CER 22pF ±10% 50V
C586	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C587	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C588 thru C590	CSM-AB82P50V-6	CC45UJ1H820KY	C: FXD CER 82pF ±10% 50V
L591	LCL-C00561-1	*	L: FXD Coil
L592	LCL-C00562-1	*	L: FXD Coil
L593	LCL-C00490-1	*	L: FXD Coil
L594	LCL-C00562-1	*	L: FXD Coil
L595	LCL-C00561-1	*	L: FXD Coil
L596 thru L598	LCL-B00376-1	TPF0410-331K	L: FXD Coil
L599	LCL-C00013-1	CSL0812-181J	L: FXD Coil 180μH
L600	LCL-C00013-1	CSL0812-181J	L: FXD Coil 180μH
L601	LCL-C00501-1	*	L: FXD Coil
L602	LCL-B00376-1	TPF0410-331K	L: FXD Coil
L603	LCL-B00376-1	TPF0410-331K	L: FXD Coil
L604	LCL-C00501-1	*	L: FXD Coil
L605	LCL-B00376-1	TPF0410-331K	L: FXD Coil
L606	LCL-B00376-1	TPF0410-331K	L: FXD Coil
L607	LCL-C00501-1	*	L: FXD Coil
L608 thru L610	LCL-B00376-1	TPF0410-331K	L: FXD Coil
L611	LCL-B00375-1	TPF0410-221K	L: FXD Coil
L612	LCL-B00141-1	TPF0410-471K	L: FXD Coil
L613	LCL-C00563A-1	*	L: FXD Coil
L614	LCL-B00376-1	TPF0410-331K	L: FXD Coil
L615	LCL-B00375-1	TPF0410-221K	L: FXD Coil
L616	LCL-B00141-1	TPF0410-471K	L: FXD Coil
L617	LCL-C00563A-1	*	L: FXD Coil
L618	LCL-B00376-1	TPF0410-331K	L: FXD Coil
L619	LCL-B00375-1	TPF0410-221K	L: FXD Coil
L620	LCL-B00141-1	TPF0410-471K	L: FXD Coil
L621	LCL-C00563A-1	*	L: FXD Coil
L622	LCL-B00376-1	TPF0410-331K	L: FXD Coil
L623	LCL-B00375-1	TPF0410-221K	L: FXD Coil
L624	LCL-B00141-1	TPF0410-471K	L: FXD Coil
L625	LCL-C00563A-1	*	L: FXD Coil
L626	LCL-B00376-1	TPF0410-331K	L: FXD Coil
X631	DXD-000445-1	*	Crystal
X632	DXD-000446-1	*	Crystal
X633	DXD-000445-1	*	Crystal
X634	DXD-000446-1	*	Crystal
J641	JCR-AF050PX02-1	HIF3F-50P-2.54DS	Connector

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1	SIA-324-1	LM324	IC: Quadruple Operational Amplifier
IC2	SIA-324-1	LM324	IC: Quadruple Operational Amplifier
IC3	SIT-74LS138-9	SN74LS138N	IC: Decoder/Demultiplexer Low Power
IC4	SIT-74LS138-9	SN74LS138N	IC: Decoder/Demultiplexer Low Power
IC5	SIT-74LS00-9	SN74LS00N	IC: Quadruple 2-Input NAND Gate Low Power
IC6	SIT-74LS02-9	SN74LS02N	IC: Quadruple 2-Input NOR Gate
IC7	SIT-74LS14-9	SN74LS14N	IC: Hex Schmitt-Trigger Inverter Low Power
IC8	SIT-74LS138-9	SN74LS138N	IC: Decoder/Demultiplexer Low Power
IC9	SIA-324-1	LM324	IC: Quadruple Operational Amplifier
IC10	SIT-74LS42-9	SN74LS42N	IC: 4-Line-to-10 Line Decoder Low Power
IC11 thru IC14	SIT-74LS273-9	SN74LS273	IC: Octal D-Type Flip Flop Low Power
IC15	SIT-74LS244-9	SN74LS244N	IC: Octal Buffer/Line Driver/Line Receiver Low Power
IC16 thru IC19	SIA-324-1	LM324	IC: Quadruple Operational Amplifier
IC20	SIT-7416-9	SN7416N	IC: Hex Inverter Buffer/Driver with Open-Collector High-Voltage Output
IC21	SIA-324	LM324	IC: Quadruple Operational Amplifier
Q31	STN-2SC1254	2SC1254	Transistor SI NPN
Q32	STP-2SA1015	2SA1015	Transistor SI PNP
Q33 thru Q38	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q39	STP-2SA1015	2SA1015	Transistor SI PNP
Q40	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q41	STP-2SA1015	2SA1015	Transistor SI PNP
Q42	SFN-2SK33	2SK33F	FET Junction N-Channel
Q43	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q44	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q45	STP-2SA1015	2SA1015	Transistor SI PNP
Q46	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q47	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q48	SFN-2SK33	2SK33F	FET Junction N-Channel
Q49	STP-2SA1015	2SA1015	Transistor SI PNP
Q50	SFN-2SK33	2SK33F	FET Junction N-Channel
Q51	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q52	SFN-2SK33	2SK33F	FET Junction N-Channel
Q53	STP-2SA1015	2SA1015	Transistor SI PNP
Q54	SFN-2SK33	2SK33F	FET Junction N-Channel
Q55	STP-2SA1015-1	2SA1015	Transistor SI PNP
D61 thru D88	SDS-1S2222	1S2222	Diode SI
D89	SDS-1S953	1S953	Diode SI
D90	SDS-1S953	1S953	Diode SI
D91 thru D126	SDS-1S2222	1S2222	Diode SI

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Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R131	RCB-AH4R7K	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R132	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R133	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R134	RCB-AH820	RD25S820ΩJ	R: FXD CAR 820Ω ±5% 1/4W
R135	RCB-AH1K	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R136	RCB-AH100	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R137	RCB-AH270-1	RD25S270ΩJ	R: FXD CAR 270Ω ±5% 1/4W
R138	RCB-AH47	RD25S47ΩJ	R: FXD CAR 47Ω ±5% 1/4W
R139	RVR-BE100	X6T100Ω	R: VAR WW 100Ω
R140	RVR-BE100	X6T100Ω	R: VAR WW 100Ω
R141	RCB-AH6R8K	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R142	RCB-AH6R8K	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R143	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R144	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R145	RCB-AH2.2K	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R146	RMF-AR330QFK	SN14K2E330ΩF	R: FXD Metal FLM 330Ω ±1% 1/4W
R147	RMF-AR180QFK	SN14K2E180ΩF	R: FXD Metal FLM 180Ω ±1% 1/4W
R148	RVR-BE50-1	X6T50Ω	R: VAR WW 50Ω
R149	RCB-AH220K	RD25S220KΩJ	R: FXD CAR 220kΩ ±5% 1/4W
R150	RCB-AH1R2K	RD25S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/4W
R151	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R152	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R153	RCB-AH2R2K	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R154	RMF-AR270QFK	SN14K2E270ΩF	R: FXD Metal FLM 270Ω ±1% 1/4W
R155	RMF-AR390QFK	SN14K2E390ΩF	R: FXD Metal FLM 390Ω ±1% 1/4W
R156	RVR-BE100	X6T100Ω	R: VAR CER 100Ω
R157	RCB-AH220K	RD25S220KΩJ	R: FXD CAR 220kΩ ±5% 1/4W
R158	RCB-AH1R2K	RD25S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/4W
R159	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R160	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R161	RCB-AH2R2K	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R162	RMF-AR220QFK	SN14K2E220ΩF	R: FXD Metal FLM 220Ω ±1% 1/4W
R163	RMF-AR750QFK	SN14K2E750ΩF	R: FXD Metal FLM 750Ω ±1% 1/4W
R164	RVR-BE100	X6T100Ω	R: VAR WW 100Ω
R165	RCB-AH220K	RD25S220KΩJ	R: FXD CAR 220kΩ ±5% 1/4W
R166	RCB-AH1R2K	RD25S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/4W
R167	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R168	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R169	RCB-AH2R2K	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R170	RMF-AR100QFK	SN14K2E100ΩF	R: FXD Metal FLM 100Ω ±1% 1/4W
R171	RMF-AR750QFK	SN14K2E750ΩF	R: FXD Metal FLM 750Ω ±1% 1/4W
R172	RVR-BE100	X6T100Ω	R: VAR WW 100Ω
R173	RCB-AH220K	RD25S220KΩJ	R: FXD CAR 220kΩ ±5% 1/4W
R174	RCB-AH1R2K	RD25S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/4W
R175	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R176	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R177	RCB-AH2R2K	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R178 thru R186	RMF-AR68KFK	SN14K2E68KΩF	R: FXD Metal FLM 68kΩ ±1% 1/4W
R187	RMF-AR820QFK	SN14K2E820ΩF	R: FXD Metal FLM 820Ω ±1% 1/4W
R188 thru R196	RMF-AR10QFK	SN14K2E10ΩF	R: FXD Metal FLM 10Ω ±1% 1/4W
R197 thru R206	RCB-AH4R7K	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R207	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R208	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R209	RCB-AH4R7K	RD25S4.7KΩF	R: FXD CAR 4.7kΩ ±5% 1/4W
R210	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R211	RCB-AH820	RD25S820ΩJ	R: FXD CAR 820Ω ±5% 1/4W
R212	RCB-AH1K	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R213	RCB-AH10	RD25S10ΩJ	R: FXD CAR 10Ω ±5% 1/4W
R214	RCB-AH10	RD25S10ΩJ	R: FXD CAR 10Ω ±5% 1/4W
R215	RCB-AH100	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R216	RCB-AH100	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R217	RCB-AH270-1	RD25S270ΩJ	R: FXD CAR 270Ω ±5% 1/4W
R218	RCB-AH47	RD25S47ΩJ	R: FXD CAR 47Ω ±5% 1/4W
R219			Not assigned
R220	RVR-BE100	X6T100Ω	R: VAR CER 100Ω
R221	RCB-AH6R8K	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R222	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R223	RCB-AH5R6K-1	RD25S5.6KΩ	R: FXD CAR 5.6kΩ ±5% 1/4W
R224	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R225	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R226	RCB-AH2R7K	RD25S2.7KΩJ	R: FXD CAR 2.7kΩ ±5% 1/4W
R227	RCB-AH1R2K	RD25S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/4W
R228	RCB-AH390	RD25S390ΩJ	R: FXD CAR 390Ω ±5% 1/4W
R229	RCB-AH270	RD25S270ΩJ	R: FXD CAR 270Ω ±5% 1/4W
R230	RCB-AH82	RD25S82ΩJ	R: FXD CAR 82Ω ±5% 1/4W
R231 thru R234	RCB-AH5R6K	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R235 thru R238	RCB-AH2R2K	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R239	RCB-AH120-1	RD25S120ΩJ	R: FXD CAR 120Ω ±5% 1/4W
R240 thru R242	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R243	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R244	RCB-AH8R2K	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R245	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R246	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R247	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R248	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R249	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R250	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R251	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FCD CAR 5.6kΩ ±5% 1/4W
R252	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R253	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R254	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R255	RCB-AH3R3K	ΩD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R256	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R257	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R258	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R259	RCB-AH150	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R260	RCB-AH47-1	RD25S47ΩJ	R: FXD CAR 47Ω ±5% 1/4W
R261	RVR-BE100	X6T100Ω	R: VAR WW 100Ω
R262			Not assigned
R263	RVR-BE20	X6T20Ω	R: VAR WW 20Ω
R264	RCB-AH100	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R265	RCB-AH820	RD25S820ΩJ	R: FXD CAR 820Ω ±5% 1/4W
R266	RCB-AH2R2K	RD25S2.2KΩ	R: FXD CAR 2.2kΩ ±5% 1/4W
R267	RCB-AH470	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R268	RCB-AH8R2K	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R269	RCB-AH6R8K	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R270	RCB-AH1R5K-1	RD25S1.5KΩJ	R: FXD CAR 1.5kΩ ±5% 1/4W
R271	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R272	RCB-AH390-1	RD25S390ΩJ	R: FXD CAR 390Ω ±5% 1/4W
R273	RCB-AH180-1	RD25S180ΩJ	R: FXD CAR 180Ω ±5% 1/4W
R274	RCB-AH39-1	RD25S39ΩJ	R: FXD CAR 39Ω ±5% 1/4W
R275 thru R277	RCB-AH5R6K	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R278 thru R280	RCB-AH2R2K	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R281 thru R283	RCB-AH5R6K	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R284 thru R286	RCB-AH2R2K	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R287	RCB-AH33K	RD25S33KΩJ	R: FXD CAR 33kΩ ±5% 1/4W
R288	RCB-AH33K	RD25S33KΩJ	R: FXD CAR 33kΩ ±5% 1/4W
R289	RCB-AK220-1	RD50S220ΩJ	R: FXD CAR 220Ω ±5% 1/2W
R290	RCB-AH150	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R291	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R292	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R293	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R294	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R295	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R296	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R297	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R298	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R299	RCB-AH2R7K	RD25S2.7KΩJ	R: FXD CAR 2.7kΩ ±5% 1/4W
R300	RCB-AH1R2K	RD25S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/4W
R301	RCB-AH390	RD25S390ΩJ	R: FXD CAR 390Ω ±5% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R302	RCB-AH270	RD25S270ΩJ	R: FXD CAR 270Ω ±5% 1/4W
R303	RCB-AH82	RD25S82ΩJ	R: FXD CAR 82Ω ±5% 1/4W
R304	RCB-AH39	RD25S39ΩJ	R: FXD CAR 39Ω ±5% 1/4W
R305 thru R309	RCB-AH5R6K	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R310 thru R314	RCB-AH2R2K	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R315	RCB-AH120	RD25S120ΩJ	R: FXD CAR 120Ω ±5% 1/4W
R316	RCB-AH680	RD25S680ΩJ	R: FXD CAR 680Ω ±5% 1/4W
R317	RVR-BE100	X6T100Ω	R: VAR WW 100Ω
R318	RCB-AH560	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R319	RCB-AH560	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R320	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R321	RCB-AH8R2K	RD25S8.2KΩJ	R: FXD CAR 8.2KΩ ±5% 1/4W
R322	RCB-AH47K	RD25S47KΩJ	R: FXD CAR 47kΩ ±5% 1/4W
R323	RCB-AH47K	RD25S47KΩJ	R: FXD CAR 47kΩ ±5% 1/4W
R324	RCB-AH150	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R325	RCB-AK220-1	RD50S220ΩJ	R: FXD CAR 220Ω ±5% 1/2W
R326			Not assigned
R327			Not assigned
R328 thru R331	RCB-AH2R2K	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R332	RCB-AH33-1	RD25S33ΩJ	R: FXD CAR 33Ω ±5% 1/4W
R333	RCB-AH100	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R334 thru R336			Not assigned
R337	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R338	RCB-AH10-1	RD25S10ΩJ	R: FXD CAR 10Ω ±5% 1/4W
R339	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R340	DSP-000015-1	21D28	Thermister
C341	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C342	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C343	CSM-AC22P50V	22PF50WV	C: FXD CER 22pF ±10% 50V
C344 thru C348	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C349	CTA-AB10U35V	221M3502-106M	C: FXD ELECT TANTAL 10μF ±20% 35V
C350	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C351	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C352	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C353	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C354	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C355	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C356	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C357	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C358	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C359	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C360	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047µF +80, -20% 50V
C361 thru C374	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C375	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047µF +80, -20% 50V
C376	CSM-AC15P50V	15PF50WV	C: FXD CER 15pF ±10% 50V
C377 thru C379	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C380	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047µF +80, -20% 50V
C381	CTA-AB10U35V	221M3502-106M	C: FXD ELECT TANTAL 10µF ±20% 35V
C382	CTA-AB10U35V	221M3502-106M	C: FXD ELECT TANTAL 10uF ±20% 35V
C383 thru C392	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C393	CFM-AL2000P-3	CQ08S2B-20000-J02	C: FXD Styrol 2000pF
C394	CTM-AC20P	ECV1ZW20X32	C: VAR CER 20pF
C395	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C396	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047uF +80, -20% 50V
C397	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C398	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C399	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047µF +80, -20% 50V
C400	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047µF +80, -20% 50V
C401	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C402	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C403	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047uF +80, -20% 50V
C404 thru C406	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C407	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047µF +80, -20% 50V
C408 thru C410	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C411	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047uF +80, -20% 50V
C412	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C413	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C414	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047uF +80, -20% 50V
C415 thru C417	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C418	CMC-AB10PR5K-4	DM10D100J5	C: FXD DIPPED MICA 10pF ±5% 500V
C419			Not assigned
C420	CTM-AC6P	ECV1ZW06X32	C: VAR CER 6pF
C421	CTM-AC20P	ECV1ZW20X32	C: VAR CER 20pF
C422	CMC-AB47PR3K-4	DM10D470J3	C: FXD DIPPED MICA 47pF ±5% 300V
C423			Not assigned
C424	CSM-AB27P50V-6	CC45U1H270KY	C: FXD CER 27pF ±10% 50V
C425 thru C437	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C438	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047µF +80, -20% 50V
C439	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C440	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047µF +80, -20% 50V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C441	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C442	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C443	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047µF +80, -20% 50V
C444 thru C449	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C450	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047µF +80, -20% 50V
C451 thru C455	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C456	CFM-AL2000P-3	CQ08S2B-20000-J02	C: FXD Styrol 2000pF
C457	CTM-AC20P	ECV1ZW20X32	C: VAR CER 20pF
C458	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C459	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C460	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047µF +80, -20% 50V
C461	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C462	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047µF +80, -20% 50V
C463	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C464	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047µF +80, -20% 50V
C465	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C466			Not assigned
C467 thru C474	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C475 thru C478	CCK-AA100U25V	25T100	C: FXD ELECT 100µF 25V
C479	CCK-AA100U10V	10T100	C: FXD ELECT 100µF 10V
C480	CCK-AA100U10V	10T100	C: FXD ELECT 100µF 10V
C481 thru C483	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C484 thru C488	CTA-AC1U50V	242M5002-105M	C: FXD ELECT TANTAL 1µF ±20% 50V
C489 thru C498	CTA-ACR01U50V	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C499			Not assigned
C500	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C501	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C502	CSM-AC22P50V-1	22PF50WV	C: FXD CER 22pF ±10% 50V
C503	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C504	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C505	CSM-AB82P50V-6	CC45UJ1H820KY	C: FXD CER 82pF ±10% 50V
C506	CSM-AB82P50V-6	CC45UJ1H820KY	C: FXD CER 82pF ±10% 50V
L511 thru L513	LCL-B00376-1	TPF0410-331K	L: FXD Coil 330µH
L514	LCL-C00501-1	*	L: FXD Coil
L515	LCL-B00376-1	TPF0410-331K	L: FXD Coil 330µH
L516	LCL-B00376-1	TPF0410-331K	L: FXD Coil 330µH
L517	LCL-B00375-1	TPF0410-221K	L: FXD Coil
L518	LCL-B00376-1	TPF0410-331K	L: FXD Coil 330µH

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
L519	LCL-B00141-1	TPF0410-471K	L: FXD Coil
L520	LCL-C00563A-1	*	L: FXD Coil
L521	LCL-B00376-1	TPF0410-331K	L: FXD Coil 330uH
L522	LCL-C00501-1	*	L: FXD Coil
L523 thru L525	LCL-B00376-1	TPF0410-331K	L: FXD Coil
L526	LCL-C00013-1	CSL0812-181J	L: FXD Coil 180uH
L527	LCL-C00013-1	CSL0812-181J	L: FXd Coil 180uH
L528	LCL-T00084-1	*	L: FXD Coil
L529	LCL-B00376-1	TPF0410-331K	L: FXD Coil
X541	DXD-000445-1	*	Crystal
J545	JCR-AF050PX02-1	HIF3F-50P-2.54DS	Connector
Q601	SFN-2SK33	2SK33F	FET Junction N-Channel
Q602	STP-2SA1015	2SA1015	Transistor SI PNP
Q603	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q604	STP-2SA1015	2SA1015	Transistor SI PNP
Q605	SFN-2SK33	2SK33F	FET Junction N-Channel
Q606	SFN-2SK33	2SK33F	FET Junction N-Channel
Q607	STP-2SA1015	2SA1015	Transistor SI PNP
Q608	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q609	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q610	STP-2SA1015	2SA1015	Transistor SI PNP
Q611	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
D621 thru D623	SDS-1S2222	1S2222	Diode SI
D624	SDS-1S2222	1S2222	Diode SI
D625	SDS-1S2222	1S2222	Diode SI
R628	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3KΩ ±5% 1/4W
R629	RCB-AH2R2K	RD25S2.2KΩJ	R: FXD CAR 2.2KΩ ±5% 1/4W
R630	RCB-AH5R6K	RD25S5.6KΩJ	R: FXD CAR 5.6KΩ ±5% 1/4W
R631	RCB-AH39-1	RD25S39ΩJ	R: FXD CAR 39Ω ±5% 1/4W
R632	RCB-AH150-1	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R633	RCB-AH8R2K-1	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R634			Not assigned
R635	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R636	RCB-AH10-1	RD25S10ΩJ	R: FXD CAR 10Ω ±5% 1/4W
R637	RCB-AH51-1	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R638	RCB-AH47K-1	RD25S47KΩJ	R: FXD CAR 47kΩ ±5% 1/4W
R639	RCB-AH47K-1	RD25S47KΩJ	R: FXD CAR 47kΩ ±5% 1/4W
R640	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R641	RCB-AH47K-1	RD25S47KΩJ	R: FXD CAR 47kΩ ±5% 1/4W
R642	RCB-AH47K-1	RD25S47KΩJ	R: FXD CAR 47kΩ ±5% 1/4W
R643	RCB-AK220-1	RD50S220ΩJ	R: FXD CAR 220Ω ±5% 1/2W
R644	RCB-AH150-1	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R645	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R646	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R647	RCB-AH3R3K-1	RD25S3.3kΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R648	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R649	RCB-AH47K-1	RD25S47KΩJ	R: FXD CAR 47kΩ ±5% 1/4W
R650	RCB-AH47K-1	RD25S47KΩJ	R: FXD CAR 47kΩ ±5% 1/4W
R651	RCB-AH39-1	RD25S39ΩJ	R: FXD CAR 39Ω ±5% 1/4W
R652	RCB-AH150-1	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R653	RCB-AH51-1	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R654	RCB-AH15	RD25S15ΩJ	R: FXD CAR 15Ω ±5% 1/4W
R655	RCB-AH10-1	RD25S10ΩJ	R: FXD CAR 10Ω ±5% 1/4W
R656	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R657	RCB-AH8R2K-1	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R658	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R659	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10KΩ ±5% 1/4W
R660	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R661	RCB-AH39-1	RD25S39ΩJ	R: FXD CAR 39Ω ±5% 1/4W
R662	RCB-AH150-1	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R663	RCB-AH51-1	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R664	RCB-AH15	RD25S15ΩJ	R: FXD CAR 15Ω ±5% 1/4W
R665	RCB-AH10-1	RD25S10ΩJ	R; FXD CAR 10Ω ±5% 1/4W
R666	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R667	RCB-AH8R2K-1	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R668	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R669	RVR-BE20	X6T20Ω	R: VAR WW 20Ω
R670 thru R678	RCB-AH15-1	RD25S15ΩJ	R: FXD CAR 15Ω ±5% 1/4W
R679			Not assigned
R680	RMF-AR68QFK-1	SN14K2E68ΩF	R: FXD Metal FLM 68Ω ±1% 1/4W
C681	CTM-AC20P	ECV1ZW20X32	C: VAR CER 20pF
C682	CMC-AB47PR3K-4	DM10D470J3	C: FXD DIPPED MICA 47pF ±5% 300V
C683 thru C685	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C686	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047uF +80, -20% 50V
C687	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C688	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047uF +80, -20% 50V
C689 thru C691	CSM-ACR01U50V-1	0.01UF50WV	C: RXD CER 0.01uF +80, -20% 50V
C692	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047uF +80, -20% 50V
C693	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C694	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C695	CMC-AB47PR3K-4	DM10D470J3	C: FXD DIPPED MICA 47pF ±5% 300V
C696	CTM-AC20P	ECV1ZW20X32	C: VAR CER 20pF
C697	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C698	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047uF +80, -20% 50V
C699	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C700	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C701	CMC-AB47PR3K-4	DM10D470J3	C: FXD DIPPED MICA 47pF ±5% 300V
C702	CTM-AC20P	ECV1ZW20X32	C: VAR CER 20pF

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C703	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C704	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C705 thru C707	CSM-AC22P50V-1	22PF50WV	C: FXD CER 22pF ±10% 50V
C708	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C709	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
L711	LCL-B00375-1	TPF0410-221K	L: FXD Coil 220μH
L712	LCL-B00141-1	TPF0410-471K	L: FXD Coil 470μH
L713	LCL-B00376-1	TPF0410-331K	L: FXD Coil 330μH
L714	LCL-B00376-1	TPF0410-331K	L: FXD Coil 330μH
L715	LCL-B00375-1	TPF0410-221K	L: FXD Coil 220μH
L716	LCL-B00141-1	TPF0410-471K	L: FXD Coil 470μH
L717	LCL-B00376-1	TPF0410-331K	L: FXD Coil 330μH
L718	LCL-B00375-1	TPF0410-221K	L: FXD Coil 220μH
L719	LCL-B00141-1	TPF0410-471K	L: FXD Coil 470μH
L720	LCL-B00376-1	TPF0410-331K	L: FXD Coil 330μH
X731	DXD-000445-1	*	Crystal
X732	DXD-000446-1	*	Crystal
X733	DXD-000446-1	*	Crystal
R741	RCB-AH47K-1	RD25S47KΩJ	R: FXD CAR 47kΩ ±5% 1/4W
R742	RCB-AH47K-1	RD25S47KΩJ	R: FXD CAR 47kΩ ±5% 1/4W
R743	RCB-AH150-1	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R744	RCB-AK220-1	RD50S220ΩJ	R: FXD CAR 220Ω ±5% 1/2W
	JTT-AB00EX04-1	A-105	Hermetic Seal

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1 thru IC4	SHB-000554	*	IC: Hybrid
IC5	SHB-000555-1	*	IC: Summing Amplifier
IC6	SHB-000555-1	*	IC: Summing Amplifier
IC7	SIA-TL084-6	TL084ACN	IC: JFET Input Operational Amplifier
IC8	SIA-356-1	LF356H	IC: Junction FET Input Type Operational Amplifier
IC9	SIA-DG201-1	DG201BK	IC: Quad Monolithic SPST CMOS Analog Switch
IC10	SIA-356-1	LF356AH	IC: Junction FET INPUT Type Operational Amplifier
IC11	SIA-357-1	LF357H	IC: JFET Input Amplifier Wide Band Decompensated
IC12	SIA-357-2	LF357H	IC: JFET Input Amplifier Wide Band Decompensated
IC13	SIA-356-1	LF356	IC: Junction FET Input Type Operational Amplifier
IC14	SIA-DG201-1	DG201BK	IC: Quad Monolithic SPST CMOS Analog Switch
IC15	SIA-356-1	LF356	IC: Junction FET Input Type Operational Amplifier
IC16	SIA-319-1	LM319H	IC: High Speed Dual Comparator
IC17	SIA-356-1	LF356H	IC: Junction FET INPUT Type Operational Amplifier
IC18	SIA-357-2	LF357H	IC: JFET Input Amplifier Wide Band Decompensated
IC19	SIA-357-2	LF357H	IC: JFET Input Amplifier Wide Band Decompensated
IC20 thru IC22	SIA-324-1	LM324	IC: Quadruple Operational Amplifier
IC23	SIA-339-1	LM339	IC: Quad Comparator
IC24	SIA-DG201-1	DG201BK	IC: Quad Monolithic SPST CMOS Analog Switch
IC25 thru IC27	SIT-74LS174	SN74LS174N	IC: Hex D-Type Flip Flop Low Power
IC28	SIT-74LS138	SN74LS138N	IC: 3 to 8 Line Decoder Multiplexer Low Power
IC29	SIA-357-1	LF357H	IC: JFET Input Amplifier Wide Band Decompensated
IC30	SIT-74LS74	SN74LS74N	IC: Dual D-Type Positive - Edge - Triggered Flip Flop with Preset AND Clear Low Power
Q41	STN-2SC1426-1	2SC1426	Transistor SI NPN
Q42	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q43	STP-2SA1015-1	2SA1015	Transistor SI PNP
Q44 thru Q46	STN-2SC1730-1	2SC1730	Transistor SI NPN
Q47	STN-2SC1426-1	2SC1426	Transistor SI NPN
Q48	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q49	STP-2SA1015-1	2SA1015	Transistor SI PNP
Q50 thru Q59	STN-2SC1730-1	2SC1730	Transistor SI NPN
Q60	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q61	STP-2SA1015-1	2SA1015	Transistor SI PNP
Q62	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q63	STP-2SA1015-1	2SA1015	Transistor SI PNP

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Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
Q64	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q65	STP-2SA1015-15	2SA1015	Transistor SI PNP
Q66 thru Q70	STN-2SC1730-1	2SC1730	Transistor SI NPN
Q71 thru Q74	STP-2SA1015-1	2SA1015	Transistor SI PNP
Q75	STN-2SC639-1	2SC639	Transistor SI NPN
Q76			Not assigned
Q77	STN-2SC1730-1	2SC1730	Transistor SI NPN
Q78	STN-2SC1730-1	2SC1730	Transistor SI NPN
Q79	DGP-TT0002-1	2SC1707AH	Transistor SI NPN
D81	SDS-1S953-1	1S953	Diode SI
D82	SDS-1S953-1	1S953	Diode SI
D83	SDS-1SS97-1	1SS97	Diode SI
D84	SDS-1SS97-1	1SS97	Diode SI
D85	SDS-1S2222-1	1S2222	Diode SI
D86	SDS-1S953-1	1S953	Diode SI
D87	SDS-1S953-1	1S953	Diode SI
D88	SDS-1SS97-1	1SS97	Diode SI
D89	SDS-1SS97-1	1SS97	Diode SI
D90 thru D101	SDS-1S2222-1	1S2222	Diode SI
D102	SDS-LD1-1	LD-1	Diode SI
D103	SDZ-WZ120	WZ-120	Zener Diode
D104 thru D107	SDS-1S2222-1	1S2222	Diode SI
D108 thru D111	SDS-1SS97-1	1SS97	Diode SI
D112	SDS-LD1-1	LD-1	Diode SI
D113	SDZ-D030-1	RD3.0F	Zener Diode
D114 thru D119	SDS-1S2222-1	1S2222	Diode SI
D120			Not assigned
R121	RMF-AR300QFK-1	SN14K2E300ΩF	R: FXD Metal FLM 300Ω ±1% 1/4W
R122	RMF-AR20QFK-1	SN14K2E20ΩF	R: FXD Metal FLM 20Ω ±1% 1/4W
R123	RMF-AR300QFK-1	SN14K2E300ΩF	R: FXD Metal FLM 300Ω ±1% 1/4W
R124	RMF-AR15KFK-1	SN14K2E15KΩF	R: FXD Metal FLM 15kΩ ±1% 1/4W
R125	RMF-AR6R8KFK-1	SN14K2E6.8KΩF	R: FXD Metal FLM 6.8kΩ ±1% 1/4W
R126	RMF-AR1R8KFK-1	SN14K2E1.8KΩF	R: FXD Metal FLM 1.8kΩ ±1% 1/4W
R127	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R128	RMF-AR560QFK-1	SN14K2E560ΩF	R: FXD Metal FLM 560Ω ±1% 1/4W
R129	RMF-AR15QFK-1	SN14K2E15ΩF	R: FXD Metal FLM 15Ω ±1% 1/4W
R130	RMF-AR47QFK-1	SN14K2E47ΩF	R: FXD Metal FLM 47Ω ±1% 1/4W
R131	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R132	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R133	RMF-AR10QFK-1	SN14K2E10ΩF	R: FXD Metal FLM 10Ω ±1% 1/4W
R134	RMF-AR10QFK-1	SN14K2E10ΩF	R: FXD METAL FLM 10Ω ±1% 1/4W
R135	RMF-AR390QFK-1	SN14K2E390ΩF	R: FXD Metal FLM 390Ω ±1% 1/4W
R136	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W/
R137	RMF-AR15KFK-1	SN14K2E15KΩF	R: FXD Metal FLM 15kΩ ±1% 1/4W
R138	RMF-AR47QFK-1	SN14K2E47ΩF	R: FXD Metal FLM 47Ω ±1% 1/4W
R139	RMF-AR100QFK-1	SN14K2E100ΩF	R: FXD Metal FLM 100Ω ±1% 1/4W
R140	RMF-AR1R5KFK-1	SN14K2E1.5KΩF	R: FXD Metal FLM 1.5kΩ ±1% 1/4W
R141	RCB-AG8R2K-1	RD12S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/8W
R142	RMF-AR560QFK-1	SN14K2E560ΩF	R: FXD Metal FLM 560Ω ±1% 1/4W
R143	RMF-AR56QFK-1	SN14K2E56ΩF	R: FXD Metal FLM 56Ω ±1% 1/4W
R144	RMF-AR120QFK-1	SN14K2E120ΩF	R: FXD Metal FLM 120Ω ±1% 1/4W
R145	RVR-BE500	X6T500Ω	R: VAR WW 500Ω
R146	RMF-AR470QFK-1	SN14K2E470ΩF	R: FXD Metal FLM 470Ω ±1% 1/4W
R147	RMF-AR470QFK-1	SN14K2E470ΩF	R: FXD Metal FLM 470Ω ±1% 1/4W
R148	RMF-AR1R5KFK-1	SN14K2E1.5KΩF	R: FXD Metal FLM 1.5kΩ ±1% 1/4W
R149	RMF-AR4R7KFK-1	SN14K2E4.7KΩF	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R150	RMF-AR8R2KFK-1	SN14K2E8.2KΩF	R: FXD Metal FLM 8.2kΩ ±1% 1/4W
R151	RMF-AR2R7KFK-1	SN14K2E2.7KΩF	R: FXD Metal FLM 2.7kΩ ±1% 1/4W
R152	RMF-AR47QFK-1	SN14K2E47ΩF	R: FXD Metal FLM 47Ω ±1% 1/4W
R153	RMF-AR820QFK-1	SN14K2E820ΩF	R: FXD Metal FLM 820Ω ±1% 1/4W
R154	RMF-AR560QFK-1	SN14K2E560ΩF	R: FXD Metal FLM 560Ω ±1% 1/4W
R155	RMF-AR47QFK-1	SN14K2E47ΩF	R: FXD Metal FLM 47Ω ±1% 1/4W
R156	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R157	RVR-BE100-1	X6S100Ω	R: VAR WW 100Ω
R158	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R159	RMF-AR10QFK-1	SN14K2E10ΩF	R: FXD Metal FLM 10Ω ±1% 1/4W
R160	RMF-AR10QFK-1	SN14K2E10ΩF	R: FXD Metal FLM 10Ω ±1% 1/4W
R161	RMF-AR390QFK-1	SN14K2E390ΩF	R: FXD Metal FLM 390Ω ±1% 1/4W
R162	RMF-AR5R6KFK-1	SN14K2E5.6KΩF	R: FXD Metal FLM 5.6kΩ ±1% 1/4W
R163	RMF-AR7R5KFK-1	SN14K2E7.5KΩF	R: FXD Metal FLM 7.5kΩ ±1% 1/4W
R164	RMF-AR47QFK-1	SN14K2E47ΩF	R: FXD Metal FLM 47Ω ±1% 1/4W
R165	RMF-AR50QFK-1	SN14K2E50ΩF	R: FXD Metal FLM 50Ω ±1% 1/4W
R166	RMF-AR1R2KFK-1	SN14K2E1.2KΩF	R: FXD Metal FLM 1.2kΩ ±1% 1/4W
R167	RMF-AR82QFK-1	SN14K2E82ΩF	R: FXD Metal FLM 82Ω ±1% 1/4W
R168	RMF-AR1R2KFK-1	SN14K2E1.2KΩF	R: FXD Metal FLM 1.2kΩ ±1% 1/4W
R169	RMF-AR390QFK-1	SN14K2E390ΩF	R: FXD Metal FLM 390Ω ±1% 1/4W
R170	RMF-AR5R6KFK-1	SN14K2E5.6KΩF	R: FXD Metal FLM 5.6kΩ ±1% 1/4W
R171	RMF-AR7R5KFK-1	SN14K2E7.5KΩF	R: FXD Metal FLM 7.5kΩ ±1% 1/4W
R172	RMF-AR100QFK-1	SN14K2E100ΩF	R: FXD Metal FLM 100Ω ±1% 1/4W
R173 thru R178	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R179	RCB-AG15K-1	RD12S15KΩJ	R: FXD CAR 15kΩ ±5% 1/8W
R180	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R181	RCB-AG10K-1	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R182	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R183	RCB-AG1R5K-1	RD12S1.5KΩJ	R: FXD CAR 1.5kΩ ±5% 1/8W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R184 thru R186	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R187	RCB-AG8R2K-1	RD12S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/8W
R188	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R189	RCB-AG10K-1	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R190	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R191	RCB-AG15K-1	RD12S15KΩJ	R: FXD CAR 15kΩ ±5% 1/8W
R192	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R193	RCB-AG1R5K-1	RD12S1.5KΩJ	R: FXD CAR 1.5kΩ ±5% 1/8W
R194	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R195	RCB-AG8R2K-1	RD12S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/8W
R196	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R197	RCB-AG15K-1	RD12S15KΩJ	R: FXD CAR 15kΩ ±5% 1/8W
R198	RCB-AG10K-1	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R199	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R200	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R201	RCB-AG1R5K-1	RD12S1.5KΩJ	R: FXD CAR 1.5kΩ ±5% 1/8W
R202	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R203	RMF-AR100QFK-1	SN14K2E100ΩF	R: FXD Metal FLM 100Ω ±1% 1/4W
R204	RMF-AR15KFK-1	SN14K2E15KΩF	R: FXD Metal FLM 15kΩ ±1% 1/4W
R205	RMF-AR100QFK-1	SN14K2E100ΩF	R: FXD Metal FLM 100Ω ±1% 1/4W
R206	RMF-AR1R5KFK-1	SN14K2E1.5KΩF	R: FXD Metal FLM 1.5kΩ ±1% 1/4W
R207	RCB-AG8R2K-1	RD12S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R208	RMF-AR56QFK-1	SN14K2E56ΩF	R: FXD Metal FLM 56Ω ±1% 1/4W
R209	RMF-AR560QFK-1	SN14K2E560ΩF	R: FXD Metal FLM 560Ω ±1% 1/4W
R210	RMF-AR470QFK-1	SN14K2E470ΩF	R: FXD Metal FLM 470Ω ±1% 1/4W
R211	RMF-AR120QFK-1	SN14K2E120ΩF	R: FXD Metal FLM 120Ω ±1% 1/4W
R212	RVR-BE500	X6T500Ω	R: VAR WW 500Ω
R213	RMF-AR100QFK-1	SN14K2E100ΩF	R: FXD Metal FLM 100Ω ±1% 1/4W
R214	RMF-AR470QFK-1	SN14K2E470ΩF	R: FXD Metal FLM 470Ω ±1% 1/4W
R215	RMF-AR1R5KFK-1	SN14K2E1.5KΩF	R: FXD Metal FLM 1.5kΩ ±1% 1/4W
R216	RMF-AR4R7KFK-1	SN14K2E4.7KΩF	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R217	RMF-AR5R6KFK-1	SN14K2E5.6KΩF	R: FXD Metal FLM 5.6kΩ ±1% 1/4W
R218 thru R223	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R224	RMF-AR3R9KFK-1	SN14K2E3.9KΩF	R: FXD Metal FLM 3.9kΩ ±1% 1/4W
R225	RCB-AG22K-1	RD12S22KΩJ	R: FXD CAR 22kΩ ±5% 1/8W
R226	RCB-AG5R6K-1	RD12S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/8W
R227	RCB-AG5R6K-1	RD12S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/8W
R228	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R229	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R230			Not assigned
R231	RVR-CB20-1	RJ6P20Ω	R: VAR CERMET 20Ω
R232	RCB-AG8R2K-1	RD12S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/8W
R233	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R234	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R235	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R236	RCB-AG8R2K-1	RD12S8.2KΩJ	R: FXD Metal FLM 8.2kΩ ±5% 1/8W
R237	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R238	RVR-BE50-1	X6T50Ω	R: VAR WW 50Ω
R239	RMF-AR68QFK-1	SN14K2E68ΩF	R: FXD Metal FLM 68Ω ±1% 1/4W
R240	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R241	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R242	RMF-AR3R9KFK-1	SN14K2E3.9KΩF	R: FXD Metal FLM 3.9kΩ ±1% 1/4W
R243	RMF-AR5R6KFK-1	SN14K2E5.6KΩF	R: FXD Metal FLM 5.6kΩ ±1% 1/4W
R244	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R245	RMF-AR100QFK-1	SN14K2E100ΩF	R: FXD Metal FLM 100Ω ±1% 1/4W
R246	RCB-AG8R2K-1	RD12S8.2KΩF	R: FXD CAR 8.2kΩ ±5% 1/8W
R247	RCB-AG470-1	RD12S470ΩJ	R: FXD CAR 470Ω ±5% 1/8W
R248	RCB-AG12K-1	RD12S12KΩJ	R: FXD CAR 12kΩ ±5% 1/8W
R249	RCB-AG470-1	RD12S470ΩJ	R: FXD CAR 470Ω ±5% 1/8W
R250	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R251	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R252	RCB-AG8R2K-1	RD12S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/8W
R253	RCB-AG180-1	RD12S180ΩJ	R: FXD CAR 180Ω ±5% 1/8W
R254	RVR-CB20-1	RJ6P20Ω	R: VAR CERMET 20Ω
R255	RCB-AG8R2K-1	RD12S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/8W
R256	RCB-AG470-1	RD12S470ΩJ	R: FXD CAR 470Ω ±5% 1/8W
R257	RCB-AG12K-1	RD12S12KΩJ	R: FXD CAR 12kΩ ±5% 1/8W
R258	RCB-AG470-1	RD12S470ΩJ	R: FXD CAR 470Ω ±5% 1/8W
R259	RCB-AG1K-1T	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R260	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R261	RCB-AG8R2K-1	RD12S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/8W
R262	RCB-AG33-1	RD12S33ΩJ	R: FXD CAR 33Ω ±5% 1/8W
R263	RVR-CB20-1	RJ6P20Ω	R: VAR CERMET 20Ω
R264	RCB-AG8R2K-1	RD12S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/8W
R265	RCB-AG470-1	RD12S470ΩJ	R: FXD CAR 470Ω ±5% 1/8W
R266	RCB-AG12K-1	RD12S12KΩJ	R: FXD CAR 12kΩ ±5% 1/8W
R267	RCB-AG470-1	RD12S470ΩJ	R: FXD CAR 470Ω ±5% 1/8W
R268	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R269	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R270	RCB-AG8R2K-1	RD12S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/8W
R271	RCB-AG33-1	RD12S33ΩJ	R: FXD CAR 33Ω ±5% 1/8W
R272	RVR-CB20-1	RJ6P20Ω	R: VAR CERMET 20Ω
R273	RCB-AG10K-1	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R274	RCB-AG15K-1	RD12S15KΩJ	R: FXD CAR 15kΩ ±5% 1/8W
R275	RCB-AG1R5K-1	RD12S1.5KΩJ	R: FXD CAR 1.5kΩ ±5% 1/8W
R276	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R277	RCB-AG4R7K	RD12S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/8W
R278	RVR-BE20K	X6T20KΩ	R: VAR WW 20kΩ
R279	RCB-AG10K	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R280	RCB-AG4R7K	RD12S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/8W
R281	RCB-AG100	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R282	RMF-AR560QFK	SN14K2E560ΩF	R: FXD Metal FLM 560Ω ±1% 1/4W
R283	RMF-AR560QFK	SN14K2E560ΩF	R: FXD Metal FLM 560Ω ±1% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R284	RCB-AG1R2K-1	RD12S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/8W
R285	RCB-AG1R2K-1	RD12S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/8W
R286			Not assigned
R287			Not assigned
R288			Not assigned
R289	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R290	RCB-AG3R9K-1	RD12S3.9KΩJ	R: FXD CAR 3.9kΩ ±5% 1/8W
R291	RCB-AG5R6K-1	RD12S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/8W
R292	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R293	RCB-AG82-1	RD12S82ΩJ	R: FXD CAR 82Ω ±5% 1/8W
R294	RVR-CB100-1	RJ6P100Ω	R: VAR CERMET 100Ω
R295	RCB-AG8R2K-1	RD12S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/8W
R296	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R297	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R298	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R299	RCB-AG8R2K-1	RD12S8.2KΩF	R: FXD CAR 8.2kΩ ±1% 1/8W
R300	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R301	RVR-BE50-1	X6T50Ω	R: VAR WW 50Ω
R302	RMF-AR68QFK-1	SN14K2E68ΩF	R: FXD Metal FLM 68Ω ±1% 1/4W
R303	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R304	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R305	RMF-AR3R9KFK-1	SN14K2E3.9KΩF	R: FXD Metal FLM 3.9kΩ ±1% 1/4W
R306	RMF-AR5R6KFK-1	SN14K2E5.6KΩF	R: FXD Metal FLM 5.6kΩ ±1% 1/4W
R307	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R308	RMF-AR100QFK-1	SN14K2E100ΩF	R: FXD Metal FLM 100Ω ±1% 1/4W
R309	RMF-AR1R2KFK-1	SN14K2E1.2KΩF	R: FXD Metal FLM 1.2kΩ ±1% 1/4W
R310	RMF-AR1R2KFK-1	SN14K2E1.2KΩF	R: FXD Metal FLM 1.2kΩ ±1% 1/4W
R311	RMF-AR5R6KFK-1	SN14K2E5.6KΩF	R: FXD Metal FLM 5.6kΩ ±1% 1/4W
R312	RMF-AR470QFK-1	SN14K2E470ΩF	R: FXD Metal FLM 470Ω ±1% 1/4W
R313	RMF-AR3R9KFK-1	SN14K2E3.9KΩF	R: FXD Metal FLM 3.9kΩ ±1% 1/4W
R314	RMF-AR5R6KFK-1	SN14K2E5.6KΩF	R: FXD Metal FLM 5.6kΩ ±1% 1/4W
R315	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R316	RMF-AR2R2KFK-1	SN14K2E2.2KΩF	R: FXD Metal FLM 2.2kΩ ±1% 1/4W
R317	RMF-AR1R2KFK-1	SN14K2E1.2KΩF	R: FXD Metal FLM 1.2kΩ ±1% 1/4W
R318	RMF-AR470QFK-1	SN14K2E470ΩF	R: FXD Metal FLM 470Ω ±1% 1/4W
R319	RMF-AR5R6KFK-1	SN14K2E5.6KΩF	R: FXD Metal FLM 5.6kΩ ±1% 1/4W
R320	RMF-AR5R6KFK-1	SN14K2E5.6KΩF	R: FXD Metal FLM 5.6kΩ ±1% 1/4W
R321	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R322	RMF-AR1R2KFK-1	SN14K2E1.2KΩF	R: FXD Metal FLM 1.2kΩ ±1% 1/4W
R323	RMF-AR1R2KFK-1	SN14K2E1.2KΩF	R: FXD Metal FLM 1.2kΩ ±1% 1/4W
R324	RMF-AR3R9KFK-1	SN14K2E3.9KΩF	R: FXD Metal FLM 3.9kΩ ±1% 1/4W
R325	RMF-AR1R2KFK-1	SN14K2E1.2KΩF	R: FXD Metal FLM 1.2kΩ ±1% 1/4W
R326	RMF-AR2R2KFK-1	SN14K2E2.2KΩF	R: FXD Metal FLM 2.2kΩ ±1% 1/4W
R327	RMF-AR2R2KFK-1	SN14K2E2.2KΩF	R: FXD Metal FLM 2.2kΩ ±1% 1/4W
R328	RMF-AR1R5KFK-1	SN14K2E1.5KΩF	R: FXD Metal FLM 1.5kΩ ±1% 1/4W
R329	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R330	RMF-AR3R3KFK-1	SN14K2E3.3KΩF	R: FXD Metal FLM 3.3kΩ ±1% 1/4W
R331	RMF-AR2R2KFK-1	SN14K2E2.2KΩF	R: FXD Metal FLM 2.2kΩ ±1% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R332	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R333	RMF-AR1R5KFK-1	SN14K2E1.5KΩF	R: FXD Metal FLM 1.5kΩ ±1% 1/4W
R334	RMF-AR3R3KFK-1	SN14K2E3.3KΩF	R: FXD Metal FLM 3.3kΩ ±1% 1/4W
R335	RVR-BE10K-1	X6T10KΩ	R: VAR WW 10kΩ
R336	MF-AR20KFK-1	SN14K2E20KΩF	R: FXD Metal FLM 20kΩ ±1% 1/4W
R337 thru R339	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R340	RMF-AR3R9KFK-1	SN14K2E3.9KΩF	R: FXD Metal FLM 3.9kΩ ±1% 1/4W
R341	RMF-AR100QFK-1	SN14K2E100ΩF	R: FXD Metal FLM 100Ω ±1% 1/4W
R342	RMF-AR20KFK-1	SN14K2E20KΩF	R: FXD Metal FLM 20kΩ ±1% 1/4W
R343	RCB-AG47K-1	RD12S47KΩJ	R: FXD CAR 47kΩ ±5% 1/8W
R344	RCB-AG15K-1	RD12S15KΩJ	R: FXD CAR 15kΩ ±5% 1/8W
R345	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4w
R346	RCB-AG47K-1	RD12S47KΩJ	R: FXD CAR 47kΩ ±5% 1/8W
R347	RCB-AG15K-1	RD12S15KΩJ	R: FXD CAR 15kΩ ±5% 1/8W
R348	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R349	RCB-AG47K-1	RD12S47KΩJ	R: FXD CAR 47kΩ ±5% 1/8W
R350	RCB-AG15K-1	RD12S15KΩJ	R: FXD CAR 15kΩ ±5% 1/8W
R351	RMF-AR12KFK-1	SN14K2E12KΩF	R: FXD Metal FLM 12kΩ ±1% 1/4W
R352	RVR-BE200-1	X6T200Ω	R: VAR WW 200Ω
R353	RMF-AR390QFK-1	SN14K2E390ΩF	R: FXD Metal FLM 390Ω ±1% 1/4W
R354	RMF-AR7R5KFK-1	SN14K2E7.5KΩF	R: FXD Metal FLM 7.5kΩ ±1% 1/4W
R355	RVR-BE100-1	X6T100Ω	R: VAR WW 100Ω
R356	RMF-AR270QFK-1	SN14K2E270ΩF	R: FXD Metal FLM 270Ω ±1% 1/4W
R357	RVR-CB5K-1	RJ6P5KΩ	R: VAR CERMET 5kΩ
R358	RCB-AG15K-1	RD12S15KΩJ	R: FXD CAR 15kΩ ±5% 1/8W
R359	RCB-AG15K-1	RD12S15KΩJ	R: FXD CAR 15kΩ ±5% 1/8W
R360	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R361	RVR-CB200-1	RJ6P200Ω	R: VAR CERMET 200Ω
R362	RCB-AG15K-1	RD12S15KΩJ	R: FXD CAR 15kΩ ±5% 1/8W
R363	DSP-000017-1	31D26	Thermister
R364	RCB-AG3R9K-1	RD12S3.9KΩJ	R: FXD CAR 3.9kΩ ±5% 1/8W
R365	RVR-BE20K	X6T20KΩ	R: VAR WW 20KΩ
R366	RCB-AG100K-1	RD12S100KΩJ	R: FXD CAR 100kΩ ±5% 1/8W
R367	RCB-AG330-1	RD12S330ΩJ	R: FXD CAR 330Ω ±5% 1/8W
R368	RCB-AG330-1	RD12S330ΩJ	R: FXD CAR 330Ω ±5% 1/8W
R369	RCB-AG100K-1	RD12S100KΩJ	R: FXD CAR 100kΩ ±5% 1/8W
R370	RVR-CB10K-1	RJ6P10KΩ	R: VAR CERMET 10kΩ
R371	RCB-AG10K	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R372	RCB-AG18K	RD12S18KΩJ	R: FXD CAR 18kΩ ±5% 1/8W
R373	RCB-AG10K	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R374	RCB-AG10K	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R375	RCB-AG18K	RD12S18KΩJ	R: FXD CAR 18kΩ ±5% 1/8W
R376	RVR-BE20K-1	X6T20KΩ	R: VAR WW 20kΩ
R377	RCB-AG15K	RD12S15KΩJ	R: FXD CAR 15kΩ ±5% 1/8W
R378	RMF-AR180KFK	SN14K2E180KΩF	R: FXD Metal FLM 180kΩ ±1% 1/4W
R379	RMF-AR270KFK	SN14K2E270KΩF	R: FXD Metal FLM 270kΩ ±1% 1/4W
R380	RMF-AR100KFK	SN14K2E100KΩF	R: FXD Metal FLM 100kΩ ±1% 1/4W

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Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R381	RMF-AR47KFK	SN14K2E47KΩF	R: FXD Metal FLM 47kΩ ±1% 1/4W
R382	RMF-AR1KFK	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R383	RCB-AG4R7K	RD12S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/8W
R384	RVR-BE20K-1	X6T20KΩ	R: VAR WW 20kΩ
R385	RCB-AG4R7T	RD12S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/8W
R386	RMF-AR5R6KFK	SN14K2E5.6KΩF	R: FXD Metal FLM 5.6kΩ ±1% 1/4W
R387	RMF-AR5R6KFK	SN14K2E5.6KΩF	R: FXD Metal FLM 5.6kΩ ±1% 1/4W
R388	RVR-BE500	X6T500Ω	R: VAR WW 500Ω
R389	RMF-AR820QFK-1	SN14K2E820ΩF	R: FXD Metal FLM 820Ω ±1% 1/4W
R390	RMF-AR22KFK	SN14K2E22KΩF	R: FXD Metal FLM 22kΩ ±1% 1/4W
R391	RMF-AR820QFK-1	SN14K2E820ΩF	R: FXD Metal FLM 820Ω ±1% 1/4W
R392	RVR-BE20K	X6T20KΩ	R: VAR WW 20kΩ
R393	RMF-AR4R7KFK-1	SN14K2E4R7KΩF	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R394	RMF-AR100QFK	SN14K2E100ΩF	R: FXD Metal FLM 100Ω ±1% 1/4W
R395	RVR-BE200	X6T200Ω	R: VAR WW 200Ω
R396	RMF-AR820KFK	SN14K2E820ΩF	R: FXD Metal FLM 820Ω ±1% 1/4W
R397	RMF-AR3.9KFK-1	SN14K2E3.9KΩF	R: FXD Metal FLM 3.9kΩ ±1% 1/4W
R398	RMF-AR820QFK-1	SN14K2E820ΩF	R: FXD Metal FLM 820Ω ±1% 1/4W
R399	RVR-BE20K	X6T20kΩ	R: FXD Metal FLM 20kΩ ±1% 1/4W
R400	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R401	RMF-AR5KFK	SN14K2E5KΩF	R: FXD Metal FLM 5kΩ ±1% 1/4W
R402	RMF-AR12KFK	SN14K2E12KΩF	R: FXD Metal FLM 12kΩ ±1% 1/4W
R403	RVR-BE1K-1	X6T1KΩ	R: VAR WW 1kΩ
R404	RMF-AR1R8KFK	SN14K2E1.8KΩF	R: FXD Metal FLM 1.8kΩ ±1% 1/4W
R405	RCB-AG15K	RD12S15K	R: FXD CAR 15kΩ ±5% 1/8W
R406	RCB-AG4R7K-1	RD12S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/8W
R407	RCB-AG12K-1	RD12S12KΩJ	R: FXD CAR 12kΩ ±5% 1/8W
R408	RCB-AG2R7K-1	RD12S2.7KΩJ	R: FXD CAR 2.7kΩ ±5% 1/8W
R409	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R410	RMF-AR1KFK-1	SN14K2E1KΩJ	R: FXD Metal FLM 1kΩ ±1% 1/4W
R411	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R412	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
C421	CCK-AB22U35V-1	35VB22	C: FXD ELECT 22μF 35V
C422	CCK-AB22U35V-1	35VB22	C: FXD ELECT 22μF 35V
C423	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C424	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C425	CCK-AB22U35V-1	35VB22	C: FXD ELECT 22μF 35V
C426	CCK-AB22U35V-1	35VB22	C: FXD ELECT 22μF 35V
C427	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C428	CCK-AB22U35V-1	35VB22	C: FXD ELECT 22μF 35V
C429	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C430	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C431	CCK-AB22U35V-1	35VB22	C: FXD ELECT 22μF 35V
C432 thru C438	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C439	CFM-AL1000P-3	CQ8S2B-10000-J02	C: FXD Styrol 1000pF
C440	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C441	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C442	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C443 thru C445	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C446 thru C448	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C449	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C450	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C451	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C452	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C453	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C454	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C455	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C456 thru C461	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C462 thru C488	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C489	CFM-AL1000P-3	CQ8S2B-10000-J02	C: FXD Styrol 1000pF
C490 thru C493	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C494	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C495 thru C498	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C499 thru C507	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C508	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C509 thru C518	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C519	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C520	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C521	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C522	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C523 thru C542	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C543	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C544	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C545 thru C550			Not assigned
C551	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C552	CSM-ACR01U50V	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C553 thru C555	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C556 thru C566	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C567	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C568	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C569	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C570	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C571	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C572 thru C575	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C576	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C577	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C578	CMC-AB56PR3K-4	DM10D560J3	C: FXD DIPPED MICA 56pF ±5% 300V
C579	CMC-AB12PR5K-6	DM10C120K5	C: FXD DIPPED MICA 12pF ±10% 500V
C580	CMC-AB120PR3K-4	DM10D121J3	C: FXD DIPPED MICA 120pF ±5% 300V
C581	CMC-AB7PR5K-6	DM10C070K5	C: FXD DIPPED MICA 7pF ±10% 500V
C582	CMC-AB120PR3K-4	DM10D121J3	C: FXD DIPPED MICA 120pF ±5% 300V
C583	CMC-AB2PR5K-2	DM10C020D5	C: FXD DIPPED MICA 2pF ±0.5% 500V
C584	CMC-AB62PR3K-4	DM10D620J3	C: FXD DIPPED MICA 62pF ±5% 300V
C585 thru C588	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C589 thru C592	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C593	CMC-AB56PR3K-4	DM10D560J3	C: FXD DIPPED MICA 56pF ±5% 300V
C594	CMC-AB12PR5K-6	DM10C120K5	C: FXD DIPPED MICA 12pF ±10% 500V
C595	CMC-AB120PR3K-4	DM10D121J3	C: FXD DIPPED MICA 120pF ±5% 300V
C596	CMC-AB7PR5K-6	DM10C070K5	C: FXD DIPPED MICA 7pF ±10% 500V
C597	CMC-AB120PR3K-4	DM10D121J3	C: FXD DIPPED MICA 120pF ±5% 300V
C598	CMC-AB2PR5K-2	DM10C020D5	C: FXD DIPPED MICA 2pF ±0.5% 500V
C599	CMC-AB62PR3K-4	DM10D620J3	C: FXD DIPPED MICA 62pF ±5% 300V
C600 thru C606	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C607	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10μF ±20% 16V
C608	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10μF ±20% 16V
C609 thru C611	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C612	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C613	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C614	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C615	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C616 thru C619	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C620 thru C623	CCK-AB22U35V-1	35VB22	C: FXD ELECT 22μF 35V
C624 thru C626	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C627	CSM-AC220P50V-1	220PF50WV	C: FXD CER 220pF ±10% 50V
C628 thru C630	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C631	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C632	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C633	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C634	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C635	CSM-AC33P50V-1	33PF50WV	C: FXD CER 33pF ±10% 50V
C636	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10μF 25V
C637	CCK-AB22U25V-1	25VB22	C: FXD ELECT 22μF 25V
C638	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C639	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C640	CFM-AC1UR2K-1	431M2003-105K	C: FXD Mylar 1μF ±10% 2kV
C641			Not assigned
C642	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C643	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C644	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C645	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C646	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C647	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C648 thru C650	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C651	CSM-AC33P50V-1	33PF50WV	C: FXD CER 33pF ±10% 50V
C652 thru C657	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C658	CTA-AC4R7U25V-1	242M2502-475M	C: FXD ELECT TANTAL 4.7μF ±20% 25V
C659 thru C661	CSM-AC8P50V-1	8PF50WV	C: FXD CER 8pF ±10% 50V
L671	LCL-C00010-1	CSL0609-181K	L: FXD Coil
L672	LCL-C00128-2	*	L: FXD Coil
L673 thru L678	LCL-C00010-1	CSL0609-181K	L: FXD Coil
L679	LCL-C00128-2	*	L: FXD Coil
L680 thru L685	LCL-C00010-1	CSL0609-181K	L: FXD Coil
L686	LCL-T00084-1	*	L: FXD Coil
L687 thru L690	LCL-C00010-1	CSL0609-181K	L: FXD Coil
L691	LCL-T00084-1	*	L: FXD Coil
L692	LCL-T00084-1	*	L: FXD Coil
L693	LCL-B00376-1	TPF0410-331K	L: FXD Coil
L694	LCL-B00495-1	TPF0410-391K	L: FXD Coil
L695	LCL-B00495-1	TPF0410-391K	L: FXD Coil
L696	LCL-B00376-1	TPF0410-331K	L: FXD Coil
L697	LCL-B00495-1	TPF0410-391K	L: FXD Coil
L698	LCL-B00495-1	TPF0410-391K	L: FXD Coil
J701	JCR-AF040PX02-1	HIF3F-40P-2.54DS	Connector
COR711 thru COR715	ESM-000129-1	Q5BRH3.4X3X1	Ferrite

TR4172
PHASE BLOCK
MEP-339

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
J11	JCF-AC001JX02-2	UM-QR	Connector
J12	JCF-AC001JX02-2	UM-QR	Connector

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1	SIA-319-1	LM319H	IC: High Speed Dual Comparator
IC2 thru IC6	SIA-356-1	LF356H	IC: Junction FET INPUT Type Operational Amplifier
IC7	SIA-311-1	LM311H	IC: Voltage Comparator
IC8	SDZ-6-1	LM399H	IC: Precision Reference
IC9 thru IC12	SIA-356-1	LF356H	IC: Junction FET INPUT Type Operational Amplifier
IC13	SIT-74LS390	SN74LS390N	IC: Dual Decode Counter Low Power
IC14	SIT-74LS73	SN74LS73N	IC: Dual J-K Master-Slave Flip Flop Low Power
IC15	SIT-74LS123	SN74LS123N	IC: Dual Retriggerable Monostable Multivibrator with Clear Low Power
IC16	SIA-DA7524-2	AD7524KN	IC: 8 bit Buffered Multiplying D/A Convertor
IC17	SIA-74LS14	SN74LS14N	IC: Hex Schmitt-Trigger Inverter Low Power
IC18	SIT-74LS00	SN74LS00N	IC: Quadruple 2-Input Positive-NAND Gate Low Power
IC19	SIA-DA7542-1	AD7542KN	IC: 12 bit D/A Convertor
IC20	SIT-74LS138	SN74LS138N	IC: 3-to-8 Line Decoder/Multiplexer Low Power
IC21	SIT-74LS175	SN74LS175N	IC: Quad D-Type Flip Flop Low Power
IC22	SIA-DA7542-1	AD7542KN	IC: 12 bit D/A Convertor
IC23	SIT-74LS02	SN74LS02N	IC: Quadruple 2-Input Positive-NOR Gate Low Power
IC24	SIA-DG201-1	DG201BK	IC: Quad Monolithic SPSTCMOS Analog Switch
IC25 thru IC27	SIA-356-1	LF356H	IC: Junction FET INPUT Type Operational Amplifier
IC28	SIA-TL082-1	TL082CP	IC: Dual Operational Amplifier
IC29	SIA-TL082-1	TL082CP	IC: Dual Operational Amplifier
IC30	SIT-74S00-1	SN74S00N	IC: Quadruple 2-Input Positive-NAND Gate
IC31	SIT-74S00-1	SN74S00N	IC: Quadruple 2-Input Positive-NAND Gate
IC32	SIT-74S74-1	SN74S74N	IC: Dual D-Type Positive-Edge-Triggered Flip Flop with Preset AND Clear
IC33	SIA-TL082-1	TL082CP	IC: Dual Operational Amplifier
Q41	STN-2SC1254-1	2SC1254	Transistor SI NPN
Q42	STN-2SC1730-1	2SC1730	Transistor SI NPN
Q43	STN-2SC1254-1	2SC1254	Transistor SI NPN
Q44	STN-2SC1730-1	2SC1730	Transistor SI NPN
Q45 thru Q52	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q53	STN-2SC2901-1	2SC2901	Transistor SI NPN
Q54	STN-2SC2901-1	2SC2901	Transistor SI NPN
Q55 thru Q60	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q61 thru Q64	STN-2SC2901-1	2SC2901	Transistor SI NPN
Q65	STP-2SA711-1	2SA711	Transistor SI PNP
Q66	STP-2SA711-1	2SA711	Transistor SI PNP
Q67	STP-2SA1015-1	2SA1015	Transistor SI PNP
Q68	STN-2SC1834-1	2SC1834	Transistor SI NPN
Q69	STN-2SC1834-1	2SC1834	Transistor SI NPN

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
Q70	STT-AD811-2	MP311	Transistor SI NPN
Q71	STN-2SC1834-1	2SC1834	Transistor SI NPN
Q72	STN-2SC1834-1	2SC1834	Transistor SI NPN
Q73	STP-2SA1015-1	2SA1015	Transistor SI PNP
Q74	SFN-2N4859-18	2N4859	FET Junction N-Channel
Q75	SFN-2SK30-1	2SK30A-TM	FET Junction N-Channel
D81 thru D88	SDS-1S2222-1	1S2222	Diode SI
D89 thru D103	SDS-1SS97-1	1SS97	Diode SI
D104 thru D108	SDS-1S953-1	1S953	Diode SI
D109	SDZ-W061-1	WZ-061	Zener Diode
R121	RCB-AG10K-1	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R122	RCB-AG10K-1	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R123	RCB-AG4R7K-1	RD12S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/8W
R124	RCB-AG330-1	RD12S330ΩJ	R: FXD CAR 330Ω ±5% 1/8W
R125	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R126 thru R128	RCB-AG10K-1	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R129	RCB-AG4R7K-1	RD12S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/8W
R130	RCB-AG6R8K-1	RD12S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/8W
R131	RCB-AG6R8K-1	RD12S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/8W
R132	RCB-AG820-1	RD12S820ΩJ	R: FXD CAR 820Ω ±5% 1/8W
R133	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R134			Not assigned
R135	RCB-AG6R8K-1	RD12S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/8W
R136	RCB-AG6R8K-1	RD12S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/8W
R137	RCB-AG180-1	RD12S180ΩJ	R: FXD CAR 180Ω ±5% 1/8W
R138	RCB-AG820-1	RD12S820ΩJ	R: FXD CAR 820Ω ±5% 1/8W
R139	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R140	RCB-AG6R8K-1	RD12S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/8W
R141	RCB-AG6R8K-1	RD12S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/8W
R142	RCB-AG820-1	RD12S820ΩJ	R: FXD CAR 820Ω ±5% 1/8W
R143	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R144			Not assigned
R145	RCB-AG6R8K-1	RD12S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/8W
R146	RCB-AG6R8K-1	RD12S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/8W
R147	RCB-AG33-1	RD12S33ΩJ	R: FXD CAR 33Ω ±5% 1/8W
R148	RCB-AG820-1	RD12S820ΩJ	R: FXD CAR 820Ω ±5% 1/8W
R149	RCB-100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R150	RCB-AG330-1	RD12S330ΩJ	R: FXD CAR 330Ω ±5% 1/8W
R151 thru R153	RCB-AG10K-1	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R154	RCB-AG4R7K-1	RD12S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/8W
R155	RCB-AG10K-1	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R156	RCB-AG330-1	RD12S330ΩJ	R: FXD CAR 330Ω ±5% 1/8W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R157	RCB-AG120-1	RD12S120ΩJ	R: FXD CAR 120Ω ±5% 1/8W
R158	RCB-AG2R2K-1	RD12S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/8W
R159	RCB-AG10K-1	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R160	RCB-AG10K-1	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R161	RCB-AG470-1	RD12S470ΩJ	R: FXD CAR 470Ω ±5% 1/8W
R162	RCB-AG2R2K-1	RD12S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/8W
R163	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R164	RCB-AG10K-1	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R165	RCB-AG10K-1	RD12S10KΩJ	R: FXD CAR 10kΩ 1/8W
R166	RCB-AG470-1	RD12S470ΩJ	R: FXD CAR 470Ω ±5% 1/8W
R167	RCB-AG2R2K-1	RD12S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/8W
R168	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R169	RCB-AG3R3K-1	RD12S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/8W
R170	RCB-AG6R8K-1	RD12S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/8W
R171	RCB-AG22-1	RD12S22ΩJ	R: FXD CAR 22Ω ±5% 1/8W
R172	RCB-AG680-1	RD12S680ΩJ	R: FXD CAR 680Ω ±5% 1/8W
R173	RCB-AG10K-1	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R174	RCB-AG560-1	RD12S560ΩJ	R: FXD CAR 560Ω ±5% 1/8W
R175	RCB-AG270-1	RD12S270ΩJ	R: FXD CAR 270Ω ±5% 1/8W
R176 thru R178	RCB-AG91-1	RD12S91ΩJ	R: FXD CAR 91Ω ±5% 1/8W
R179	RCB-AG560-1	RD12S560ΩJ	R: FXD CAR 560Ω ±5% 1/8W
R180	RCB-AG390-1	RD12S390ΩJ	R: FXD CAR 390Ω ±5% 1/8W
R181	RCB-AG560-1	RD12S560ΩJ	R: FXD CAR 560Ω ±5% 1/8W
R182	RCB-AG3R3K-1	RD12S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/8W
R183	RCB-AG6R8K-1	RD12S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/8W
R184	RCB-AG22-1	RD12S22ΩJ	R: FXD CAR 22Ω ±5% 1/8W
R185	RCB-AG680-1	RD12S680ΩJ	R: FXD CAR 680Ω ±5% 1/8W
R186	RCB-AG560-1	RD12S560ΩJ	R: FXD CAR 560Ω ±5% 1.8W
R187	RCB-AG330-1	RD12S330ΩJ	R: FXD CAR 330Ω ±5% 1/8W
R188	RCB-AG560-1	RD12S560ΩJ	R: FXD CAR 560Ω ±5% 1/8W
R189	RCB-AG3R3K-1	RD12S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/8W
R190	RCB-AG6R8K-1	RD12S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/8W
R191	RCB-AG22-1	RD12S22ΩJ	R: FXD CAR 22Ω ±5% 1/8W
R192	RCB-AG680-1	RD12S680ΩJ	R: FXD CAR 680Ω ±5% 1/8W
R193	RCB-AG270-1	RD12S270ΩJ	R: FXD CAR 270Ω ±5% 1/8W
R194	RCB-AG270-1	RD12S270ΩJ	R: FXD CAR 270Ω ±5% 1/8W
R195	RCB-AG6R8K-1	RD12S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/8W
R196	RCB-AG6R8K-1	RD12S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/8W
R197	RCB-AG470-1	RD12S470ΩJ	R: FXD CAR 470Ω ±5% 1/8W
R198	RCB-AG33-1	RD12S33ΩJ	R: FXD CAR 33Ω ±5% 1/8W
R199 thru R201	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R202	RCB-AG1R2K-1	RD12S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/8W
R203	RCB-AG470-1	RD12S470ΩJ	R: FXD CAR 470Ω ±5% 1/8W
R204	RMF-AR12KFK-1	SN14K2E12KΩF	R: FXD Metal FLM 12kΩ ±1% 1/4W
R205	RCB-AG4R7K-1	RD12S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/8W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R206	RCB-AG3R3K-1	RD12S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/8W
R207	RCB-AG560-1	RD12S560ΩJ	R: FXD CAR 560Ω ±5% 1/8W
R208	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R209	RCB-AG10K-1	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R210	RCB-AG10K-1	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R211	RCB-AG470-1	RD12S470ΩJ	R: FXD CAR 470Ω ±5% 1/8W
R212	RCB-AG2R2K-1	RD12S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/8W
R213	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R214	RCB-AG5R6K-1	RD12S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/8W
R215	RCB-AG12K-1	RD12S12KΩJ	R: FXD CAR 12kΩ ±5% 1/8W
R216	RCB-AG330-1	RD12S330ΩJ	R: FXD CAR 330Ω ±5% 1/8W
R217	RCB AG120-1	RD12S120ΩJ	R: FXD CAR 120Ω ±5% 1/8W
R218	RCB-AG1R2K-1	RD12S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/8W
R219	RCB-AG3R3K-1	RD12S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/8W
R220	RCB-AG6R8K-1	RD12S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/8W
R221	RCB-AG22-1	RD12S22ΩJ	R: FXD CAR 22Ω ±5% 1/8W
R222	RCB-AG680-1	RD12S680ΩJ	R: FXD CAR 680Ω ±5% 1/8W
R223	RCB-5R6K-1	RD12S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/8W
R224	RCB-AG12K-1	RD12S12KΩJ	R: FXD CAR 12kΩ ±5% 1/8W
R225	RCB-AG330-1	RD12S330ΩJ	R: FXD CAR 330Ω ±5% 1/8W
R226	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R226	RCB-AG1R2K-1	RD12S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/8W
R229	RCB-AG5R6K-1	RD12S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/8W
R229	RCB-AG12K-1	RD12S12KΩJ	R: FXD CAR 12kΩ ±5% 1/8W
R230	RCB-AG330-1	RD12S330ΩJ	R: FXD CAR 330Ω ±5% 1/8W
R231	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R232	RCB-AG1R2K-1	RD12S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/8W
R233 thru R240	RCB-AG10K-1	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R241	RCB-AG820-1	RD12S820ΩJ	R: FXD CAR 820Ω ±5% 1/8W
R242	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R243	RCB-AG10K-1	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R244	RCB-AG820-1	RD12S820ΩJ	R: FXD CAR 820Ω ±5% 1/8W
R245	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R246	RCB-AG10K-1	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R247	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R248	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R249	RCB-AG1R2K-1	RD12S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/8W
R250	RCB-AG470-1	RD12S470ΩJ	R: FXD CAR 470Ω ±5% 1/8W
R251	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R252	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R253	RCB-AG1R2K-1	RD12S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/8W
R254	RCB-AG470-1	RD12S470ΩJ	R: FXD CAR 470Ω ±5% 1/8W
R255	RCB-AG220-1	RD12S220ΩJ	R: FXD CAR 220Ω ±5% 1/8W
R256	RCB-AG220-1	RD12S220ΩJ	R: FXD CAR 220Ω ±5% 1/8W
R257	RMF-AR4R7KFK-1	SN14K2E4.7KΩF	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R258	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R259	RMF-AR1R2KFK-1	SN14K2E1.2KΩF	R: FXD Metal FLM 1.2kΩ ±1% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R260	RMF-AR300QFK-1	SN14K2E300ΩF	R: FXD Metal FLM 300Ω ±1% 1/4W
R261	RMF-AR300QFK-1	SN14K2E300ΩF	R: FXD Metal FLM 300Ω ±1% 1/4W
R262	RMF-AR2R2KFK-1	SN14K2E2.2KΩF	R: FXD Metal FLM 2.2kΩ ±1% 1/4W
R263	RMF-AR2R2KFK-1	SN14K2E2.2KΩF	R: FXD Metal FLM 2.2kΩ ±1% 1/4W
R264	RMF-AR12KFK-1	SN14K2E12KΩF	R: FXD Metal FLM 12kΩ ±1% 1/4W
R265	RVR-BE5K-1	X6T5KΩ	R: VAR WW 5kΩ
R266 thru R268	RCB-AG10K-1	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R269	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R270	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R271	RMF-AR5R6KFK-1	SN14K2E5.6KΩF	R: FXD Metal FLM 5.6kΩ ±1% 1/4W
R272	RMF-AR13KFK-1	SN14K2E13KΩF	R: FXD Metal FLM 13kΩ ±1% 1/4W
R273	RVR-BE1K-1	X6T1KΩ	R: VAR WW 1kΩ
R274	RMF-AR560QFK-1	SN14K2E560ΩF	R: FXD Metal FLM 560Ω ±1% 1/4W
R275	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R276	RCB-AG10K-1	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R277	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R278	RMF-AR51QFK-1	SN14K2E51ΩF	R; FXD Metal FLM 51Ω ±1% 1/4W
R279	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R280	RMF-AR500QFK-1	SN14K2E500ΩF	R: FXD Metal FLM 500Ω ±1% 1/4W
R281	RVR-BE2K-1	X6T2KΩ	R: VAR WW 2kΩ
R282	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R283	RVR-BE5K-1	X6T5kΩ	R: VAR WW 5kΩ
R284	RMF-AR22KFK-1	SN14K2E22KΩF	R: FXD Metal FLM 22kΩ ±1% 1/4W
R285	RVR-BE5K-1	X6T5KΩ	R: VAR WW 5kΩ
R286	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R287	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R288	RMF-AR2R2KFK-1	SN14K2E22KΩF	R: FXD Metal FLM 22kΩ ±1% 1/4W
R289	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R290	RMF-AR7R5KFK-1	SN14K2E7.5KΩF	R: FXD Metal FLM 7.5kΩ ±1% 1/4W
R291	RCB-AG2R2K-1	RD12S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/8W
R292	RVR-AH20K-1	K9W20KΩ	R: VAR WW 20kΩ
R293	RCB-AG220-1	RD12S220ΩJ	R: FXD CAR 220Ω ±5% 1/8W
R294	RMF-AR2R4KFK-1	SN14K2E2.4KΩF	R: FXD Metal FLM 2.4kΩ ±1% 1/4W
R295	RVR-BE1K-1	X6T1KΩ	R: VAR WW 1kΩ
R296	RMF-AR6R65KFK-1	SN14K2E6.65KΩF	R: FXD Metal FLM 6.65kΩ ±1% 1/4W
R297	RVR-BE5K-1	X6T5KΩ	R: VAR WW 5kΩ
R298	RMF-AR20KFK-1	SN14K2E20KΩF	R: FXD Metal FLM 20kΩ ±1% 1/4W
R299	RMF-AR6R8KFK-1	SN14K2E6.8KΩF	R: FXD Metal FLM 6.8kΩ ±1% 1/4W
R300	RMF-AR6R8KFK-1	SN14K2E6.8KΩF	R: FXD Metal FLM 6.8kΩ ±1% 1/4W
R301	RVR-BE5K-1	X6T5KΩ	R: VAR WW 5kΩ
R302	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R303	RMF-AR3R3KFK-1	SN14K2E3.3KΩF	R: FXD Metal FLM 3.3kΩ ±1% 1/4W
R304	RMF-AR4R2KFK-1	SN14K2E4.2KΩF	R: FXD Metal FLM 4.2kΩ ±1% 1/4W
R305	RMF-AR5R6KFK-1	SN14K2E5.6KΩF	R: FXD Metal FLM 5.6kΩ ±1% 1/4W
R306	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R307	RVR-AH20K-1	K9W20KΩ	R: VAR WW 20kΩ
R308	RCB-AG220-1	RD12S220ΩJ	R: FXD CAR 220Ω ±5% 1/8W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R309	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R310	RCB AG3R3K-1	RD12S3.3kΩJ	R: FXD CAR 3.3kΩ ±5% 1/8W
R311	RCB-AG3R3K-1	RD12S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/8W
R312	RMF-AR470QFK-1	SN14K2E470ΩF	R: FXD Metal FLM 470Ω ±1% 1/4W
R313	RMF-AR470QFK-1	SN14K2E470ΩF	R: FXD Metal FLM 470Ω ±1% 1/4W
R314	RCB-AG4R7K-1	RD12S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/8W
R315	RCB-AG10K-1	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R316	RCB-AG10K-1	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R317 thru R320	RCB-AG2R2K-1	RD12S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/8W
R321	RCB-AG330-1	RD12S330ΩJ	R: FXD CAR 330Ω ±5% 1/8W
R322	RCB-AG6R8K-1	RD12S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/8W
R323	RCB-AG8R2K-1	RD12S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/8W
R324	RCB-AG3R3K-1	RD12S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/8W
R325	RCB-AG3R3K-1	RD12S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/8W
R326	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R327	RCB-AG330-1	RD12S330ΩJ	R: FXD CAR 330Ω ±5% 1/8W
R328	RCB-AG3R3K-1	RD12S3.3KΩJ	R: FXD CAR 33kΩ ±5% 1/8W
R329	RCB-AG12K-1	RD12S12KΩJ	R: FXD CAR 12kΩ ±5% 1/8W
R330	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R331	RCB-AG4R7K-1	RD12S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/8W
R332	RCB-AG4R7K-1	RD12S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/8W
R333	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R334	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R335	RCB-AG680-1	RD12S680ΩJ	R: FXD CAR 680Ω ±5% 1/8W
R336	RCB-AG680-1	RD12S680ΩJ	R: FXD CAR 680Ω ±5% 1/8W
R337	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R338	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R339	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1KΩ ±5% 1/8W
R340	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
C341	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10μF ±20% 16V
C342	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10μF ±20% 16V
C343 thru C347	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10μF ±20% 35V
C348	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C349	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C350	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C351	CTM-AA6P-1	ECV1ZW06X53N	C: VAR CER 6pF
C352	CMC-AB100PR3K-4	DM10D101J3	C: FXD DIPPED MICA 100pF ±5% 300V
C353	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C354	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C355 thru C360	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C361 thru C363	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C364	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C365 thru C370	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C371	CTM-AA6P-1	ECV1ZW06X53N	C: VAR CER 6pF
C372	CMC-AA10PR3K-4	DM05C100K311CD	C: FXD DIPPED MICA 10pF ±0.5% 3kV
C373	CMC-AB100PR3K-4	DM10D101J3	C: FXD DIPPED MICA 100pF ±5% 300V
C374	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C375	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C376	CMC-AA10PR3K-4	DM05C100K3KD	C: FXD DIPPED MICA 10pF ±0.5% 3kV
C377	CMC-AB82PR3K-4	DM10D820J3	C: FXD DIPPED MICA 82pF ±5% 300V
C378	CMC-AB36PR3K-4	DM10D360J3	C: FXD DIPPED MICA 36pF ±0.5% 300V
C379 thru C381	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C382	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C383	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C384	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C385	CMC-AB68PR5K-4	DM10D680J3	C: FXD DIPPED MICA 68pF ±5% 300V
C386	CTM-AA10P-1	ECV1ZW10X53N	C: VAR CER 10pF
C387	CSM-ACR0150V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C388	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C389	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C390	CMC-AB68PR3K-4	DM10D680J3	C: FXD DIPPED MICA 68pF ±5% 300V
C391	CTM-AA10P-1	ECV1ZW10X53N	C: VAR CER 10pF
C392	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C393			Not assigned
C394	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C395	CMC-AB82PR3K-4	DM10D820J3	C: FXD DIPPED MICA 82pF ±5% 300V
C396	CMC-AC390PR5K-2	DM15D391J5	C: FXD DIPPED MICA 390pF ±5% 500V
C397	CMC-AC470PR3K-2	DM15D471J3	C: FXD DIPPED MICA 470pF ±5% 300V
C398	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C399	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C400	CMC-AB330PR3K-4	DM10D331J3	C: FXD DIPPED MICA 330pF ±5% 300V
C401	CMC-AB47PR3K-4	DM10D470J3	C: FXD DIPPED MICA 47pF ±5% 300V
C402	CMC-AB330PR3K-4	DM10D331J3	C: FXD DIPPED MICA 330pF ±5% 300V
C403	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C404	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.22μF +80, -20% 50V
C405	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C406	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C407	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C408	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C409	CMC-AB200PR3K-4	DM10D201J3	C: FXD DIPPED MICA 200pF±5% 300V
C410	CMC-AB82PR3K-4	DM10D820J3	C: FXD DIPPED MICA 82pF ±5% 300V
C411	CMC-AB200PR3K-4	DM10D201J3	C: FXD DIPPED MICA 200pF ±5% 300V
C412	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C413	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.47μF +80, -20% 50V
C414	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -205% 50V
C415	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10μF ±20% 16V
C416	CTA-AC2R2U35V-1	242M3502-225M	C: FXD ELECT TANTAL 2.2μF ±20% 35V
C417	CMC-AC560PR3K-2	DM15D561J3	C: FXD DIPPED MICA 560pF ±5% 300V
C418	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C419	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C420	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047uF +80, -20% 50V
C421	CMC-AB68PR3K-4	DM10D680J3	C: FCD DIPPED MICA 68pF ±5% 300V
C422	CTM-AA4P-1	ECV1ZW04X53N	C: VAR CER 4pF
C423	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C424	CMC-AB68PR3K-4	DM10D680J3	C: FXD DIPPED MICA 68pF ±5% 300V
C425	CTM-AA10P-1	ECV1ZW10X53N	C: VAR CER 10pF
C426	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C427	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022uF +80, -20% 50V
C428	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C429			Not assigned
C430	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047uF +80, -20% 50V
C431	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C432	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022uF +80, -20% 50V
C433	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C434	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C435	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022uF +80, -20% 50V
C436	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047uF +80, -20% 50V
C437	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C438	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001uF +80, -20% 50V
C439	CFM-AA1000PR1K-1	441N1003-102K	C: FXD Myler 1000pF ±10% 1kV
C440	CFM-AA6800PR1K-1	441N1003-682K	C: FXD Mylar 6800pF ±10% 1kV
C441	CMC-AB18PR5K-6	DM10C180K5	C: FXD DIPPED MICA 180pF±10% 500V
C442	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001uF +80, -20% 50V
C443	CFM-AA1000PR1K-1	441N1003-102K	C: FXD Mylar 1000pF ±10% 1kV
C444	CFM-AA6800PR1K-1	441N1003-682K	C: FXD Mylar 6800pF ±10% 1kV
C445	CMC-AB18PR5K-6	DM10C180K5	C: FXD DIPPED MICA 18pF ±10% 500V
C446 thru C451	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047uF +80, -20% 50V
C452	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10uF ±20% 16V
C453	CTA-AC2R2U35V-1	242M3502-225M	C: FXD ELECT TANTAL 2.2uF ±20% 35V
C454	CMC-AB33PR5K-4	DM10D330J5	C: FXD DIPPED MICA 33pF ±5% 500V
C455	CMC-AB33PR5K-4	DM10D330J5	C: FXD DIPPED MICA 33pF ±5% 500V
C456	CTA-AC2R2U35V-1	242M3502-225M	C: FXD ELECT TANTAL 2.2uF ±20% 35V
C457	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047uF +80, -20% 50V
C458	CFM-AAR033UR1K-1	441N1003-333K	C: FXD Mylar 0.033uF ±10% 1kV
C459	CFM-AA4700PR1K-1	441N1003-472K	C: FXD Mylar 4700pF ±10% 1kV
C460	CFM-AAR01UR1K-1	441N1003-103K	C: FXD Mylar 0.01uF ±10% 1kV
C461	CFM-AAR047UR1K-1	441N1003-473K	C: FXD Mylar 0.047uF ±10% 1kV
C462	CFM-AAR01UR1K-1	441N1003-103K	C: FXD Mylar 0.01uF +10% 1kV
C463	CFM-AAR3300PR1K-1	441N1003-332K	C: FXD Mylar 3300pF ±10% 1kV
C464	CFM-AAR047UR1K-1	441N1003-473K	C: FXD Mylar 0.047uF ±10% 1kV
C465	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001uF +80, -20% 50V
C466	CFM-AA1500PR1K-1	441N1003-152K	C: FXD Mylar 2200pF ±10% 1kV
C467	CFM-AA2200PR1K-1	441N1003-222K	C: FXD Mylar 2200pF ±10% 1kV
C468	CMC-AC470PR3K-2	DM15D471J3	C: FXD DIPPED MICA 470pF ±5% 300V
C469	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001uF +80, -20% 50V
C470 thru C472	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047uF +80, -20% 50V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C473	CTA-AC2R2U35V-1	242M3502-225M	C: FXD ELECT TANTAL 2.2uF ±20% 35V
C474	CCK-AB100U16V-1	16VB100	C: FXD ELECT 100uF 16V
C475	CTA-AC2R2U35V-1	242M3502-225M	C: FXD ELECT TANTAL 2.2uF ±20% 35V
C476	CSM-AC330P50V-1	330PF50WV	C: FXD CER 330pF ±10% 50V
C477	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10pF ±20% 16V
C478 thru C485	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047uF +80, -20% 50V
C486	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10uF ±20% 16V
C487	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10uF ±20% 16V
C488	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047uF +80, -20% 50V
C489	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001uF +80, -20% 50V
C490	CTA-AC2R2U35V-1	242M3502-225M	C: FXD ELECT TANTAL 2.2uF ±20% 35V
C491	CTA-AC2R2U35V-1	242M3502-225M	C: FXD ELECT TANTAL 2.2uF ±20% 35V
C492	CMC-AC560PR3K-2	DM15D561J3	C: FXD DIPPED MICA 560pF ±5% 300V
C493	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10uF ±20% 16V
C494 thru C496	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047uF +80, -20% 50V
C497 thru C500	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C501	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047uF +80, -20% 50V
C502	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047uF +80, -20% 50V
C503	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10uF ±20% 16V
C504	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10uF ±20% 16V
C505	CTM-AC50P-1	ECV1ZW50X32	C: VAR CER 50pF
C506	CTM-AC50P-1	ECV1ZW50X32	C: VAR CER 50pF
L511	LCL-T00084-1	*	L: FXD Coil
L512	LCL-B00374-1	TPF0410-151K	L: FXD Coil
L513	LCL-B00374-1	TPF0410-151K	L: FXD Coil
L514	LCL-B00161-1	TPF0410-151J	L: FXD Coil
L515	LCL-B00386-1	TPF0410-3R9K	L: FXD Coil
L516	LCL-B00368-1	TPF0410-100K	L: FXD Coil
L517	LCL-B00494-1	TPF0410-120K	L: FXD Coil
L518	LCL-B00354-1	TPF0410-222K	L: FXD Coil
L519	LCL-B00355-1	TPF0410-272K	L: FXD Coil
L520	LCL-B00496-1	TPF0410-8R2K	L: FXD Coil
L521	LCL-B00360-1	TPF0410-R47K	L: FXD Coil
L522	LCL-B00360-1	TPF0410-R47K	L: FXD Coil
T531 thru T534	LCL-C00117-1	*	Transformer
T535 thru T539	LCL-C00124-1	*	Transformer
X541	DNF-000140-1	*	Crystal
X542	DXD-000163-1	*	Crystal
X543 thru X545	DXD-000658-1	*	Crystal

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
X546	DXD-000657-1	*	Crystal
X547	DXD-000658-1	*	Crystal
J551	JCR-AF040PX02-1	HIF3F-40P-2.54DS	Connector
J552			Not assigned
J553			Not assigned
J554	JCF-AC001JX04-1	UM-R-PC	Connector
J555	JCP-AA003PX05-1	A-1103	Connector
J556	JCP-AA003PX05-1	A-1103	Connector

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1	SIT-74LS273	SN74LS273N	IC: Octal D-Type Flip Flop Low Power
IC2	SIA-561	AD561JD	IC: Low Cost 10-Bit monolithic D/A converter
IC3	SIT-74LS273	SN74LS273N	IC: Octal D-Type Flip Flop Low Power
IC4	SIA-561	AD561JD	IC: Low Cost 10-Bit monolithic D/A converter
IC5	SIT-74LS75	SN74LS75N	IC: 4-Bit Bistable Latch Low Power
IC6	SIT-74LS74	SN74LS74N	IC: Dual D-Type Positive-Edge-Triggered Flip-Flop Low Power
IC7	SIA-TL082	TL082CP	IC: Dual Operational Amplifier
IC8	SIT-74LS175	SN74LS175N	IC: Quad D-Type Flip-Flop Low Power
IC9	SIT-74LS244	SN74LS244N	IC: Octal Buffer/Line Driver/Line Receiver Low Power
IC10	SMM-2732-6	MBM2732A-35Z	IC: 32K UV Erasable PROM
IC11	SIT-74LS04	SN74LS04N	Hex Inverter Low Power
IC12	SIA-TL082	TL082CP	IC: Dual Operational Amplifier
IC13	SIT-74LS273	SN74LS273N	IC: Octal D-Type Flip-Flop Low Power
IC14	SIT-74LS02	SN74LS02N	IC: Quadruple 2-Input Positive-NOR Gate Low Power
IC15	SIT-74LS245	SN74LS245N	IC: Octal Bus Tranceiver Low Power
IC16	SIT-74LS02	SN74LS02N	IC: Quadruple 2-Input Positive-NOR Gate Power
Q21	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q22	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q23	STP-2SA1015-1	2SA1015	Transistor SI PNP
Q24	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
D31	SDS-1S953-1	1S953	Diode SI
R41	RCB-AH22-1	RD25S22ΩJ	R: FXD CAR 22Ω ±5% 1/4W
R42	RCB-AH5R1K-1	RD25S5.1KΩJ	R: FXD CAR 5.1kΩ ±5% 1/4W
R43	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R44	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R45	RCB-AH5R1K-1	RD25S5.1KΩJ	R: FXD CAR 5.1kΩ ±5% 1/4W
R46	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R47	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R48	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R49	RCB-AH22-1	RD25S22ΩJ	R: FXD CAR 22Ω ±5% 1/4W
R50	RCB-AH5R1K-1	RD25S5.1KΩJ	R: FXD CAR 5.1kΩ ±5% 1/4W
R51	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R52	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R53	RCB-AH5R1K-1	RD25S5.1KΩJ	R: FXD CAR 5.1kΩ ±5% 1/4W
R54	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R55	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R56	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R57 thru R59	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
C71 thru C74	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10μF 25V
C75	CTA-AC10V16V-1	242M1602-106M	C: FXD ELECT TANTAL 10μF ±20% 16V
C76	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10μF ±20% 16V
C77 thru C79	CSM-ACR022U50V	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V

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Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C80	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10μF ±20% 16V
C81	CTA-AC1U50V-1	242M5002-105M	C: FXD ELECT TANTAL 1μF ±20% 50V
C82	CSM-ACR022U50V	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C83	CSM-ACR022U50V	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C84	CSM-AC1000P50V	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C85	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10μF ±20% 16V
C86	CTA-AC1U50V-1	242M5002-105M	C: FXD ELECT TANTAL 1μF ±20% 50V
C87	CSM-ACR022U50V	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C88	CSM-ACR022U50V	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C89	CSM-AC1000P50V	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C90 thru C94	CTA-AC1U50V-2	244M5002-105M	C: FXD ELECT TANTAL 1μF ±20% 50V
C95	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C96	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C97	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C98	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
L101	LCL-B00016-1	EL0810SKI-181K	L: FXD Coil
L102	LCL-B00016-1	EL0810SKI-181K	L: FXD Coil
L103	LCL-T00084-1	*	L: FXD Coil

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
D1	SEZ-SW1DM1-1	SW1D-M1	Thyristor
TP1	LTP-000487A-1	*	Transformer
NF1	JCD-AA003PX01-1	6J4	Noise Filter
J2	JCS-AE004JX02-1	DBM-9W4S	Connector
J93	JCB-AD030JX01-1	PBRS-30P	Connector
J94	JCP-AX002PX01-1	SI-7501	Connector
J95	JCP-AX002JX01-1	SI-7502	Connector
J96			Not assigned
J97			Not assigned
F1	DFT-AG2A-1	MDX-2A	Fuse
FAN1	DMF-000487-1	9302	Fan Motor
CB1			Not assigned
CB2	DCB-RR0927X01-1	*	Cable
CB3	DCB-RS0922X01-1	*	Cable
CB74	DCB-FF0985X06-1	*	Cable
CB75	DCB-RR0925X01-1	*	Cable
CB76	DCB-SS0929X01-1	*	Cable
CB78	DCB-SS0930X01-1	*	Cable
CB79	DCB-SS0931X01-1	*	Cable
CB81	DCB-RR0926X01-1	*	Cable
CB82	DCB-SS0932X01-1	*	Cable
CB83	DCB-RR0947X07-1	*	Cable
CB84	DCB-SS0982X01-1	*	Cable
P1	JTE-AG001EX01-1	TOP-23A	
P5 thru P11	JTE-AY001JX01-1	75187-003	

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
D1	SDP-SM1-2	SM-1-02	Diode SI
D2 thru D4	SDS-RB402-2	S4VB10	Diode SI
R11 thru R14	RCB-AH100K-1	RD25S100KΩJ	R: FXD CAR 100kΩ ±5% 1/4W
R15	RVR-AD10K-1	RJ20P10KΩJ	R: VAR CERMET 10kΩ
C21	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C22	CCK-AR470U50V-1	SM50VB470	C: FXD ELECT 470μF 50V
C23	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C24	CCK-AS6800U50V-1	SM50VRSN6800	C: FXD ELECT 6800μF 50V
C25	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C26	CCK-AS6800U50V-1	SM50VRSN6800	C: FXD ELECT 6800μF 50V
C27	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C28	CCK-ASR022F16V-1	SM16VRSN22000	C: FXD ELECT 0.022μF 16V
F31	DFT-AAR2A-1	MF51NR2-10	Fuse
F32	DFN-AA2A-3	TMF51NR2(250)	Fuse
F33	DFN-AA1A-3	TMF51NR1(250)	Fuse
F34	DFN-AA2A-3	TMF51NR2(250)	Fuse
F35	DFN-AA2R5A-3	TMF51NR2.5	Fuse
J41	JCR-AB030PX03-1	HIF3-30P-2.54DSA	Connector
J42 thru J45	JCB-AC044JX02-2	CR7E-44DB-3.96DS	Connector
J46	JCB-AD030PX01-1	PBRS-30P	Connector
J47 thru J51	DFH-000625	FA-211B	Connector
J52 thru J56			Not assigned
J57	JCB-AD030JX01-1	PBRS-30-E01	Connector

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C61 thru C63	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C64	CSM-AC100P50V-1	100PF50WV	C: FXD CER 100pF ±10% 50V
C65	CSM-ACR01U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C66	CCK-AB100U16V-1	16VB100	C: FXD ELECT 100μF 16V
C67	CTA-AB2R2U35V-1	221M3502-225M	C: FXD ELECT TANTAL 2.2μF ±20% 35V
C68	CTA-AB2R2U35V-1	221M3502-225M	C: FXD ELECT TANTAL 2.2μF ±20% 35V
C69	CTA-AC1U50V-2	244M5002-105M	C: FXD ELECT TANTAL 1μF ±20% 50V
C70	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C71	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C72	CSM-AC100P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C73	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C74	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C75	CCK-AB100U16V-1	16VB100	C: FXD ELECT 100μF 16V
C76	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C77	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C78	CSM-AC100P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C79	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C80	CCK-AB100U16V-1	16VB100	C: FXD ELECT 100μF 16V
L91	LCL-T00084-1	*	L: FXD Coil
J95	JCB-AD030PX01-1	PBRS-30P	Connector
J96	JCR-AB040PX01-1	HIF3-40P-2.54DS	Connector
S101	DST-000593-1	5003-K-90°CB	Thermostat

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C61 thru C63	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1µF +80, -20% 50V
C64	CSM-AC100P50V-1	100PF50WV	C: FXD CER 100pF ±10% 50V
C65	CSM-ACR01U50V-1	0.1UF50WV	C: FXD CER 0.1µF +80, -20% 50V
C66	CCK-AB100U16V-1	16VB100	C: FXD ELECT 100µF 16V
C67	CTA-AB2R2U35V-1	221M3502-225M	C: FXD ELECT TANTAL 2.2µF ±20% 35V
C68	CTA-AB2R2U35V-1	221M3502-225M	C: FXD ELECT TANTAL 2.2µF ±20% 35V
C69	CTA-AC1U50V-1	242M5002-105M	C: FXD ELECT TANTAL 1µF ±20% 50V
C70	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1µF +80, -20% 50V
C71	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1µF +80, -20% 50V
C72	CSM-AC100P50V-1	0.001UF50WV	C: FXD CER 0.001µF +80, -20% 50V
C73	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C74	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C75	CCK-AB100U16V-1	16VB100	C: FXD ELECT 100µF 16V
C76	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1µF +80, -20% 50V
C77	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1µF +80, -20% 50V
C78	CSM-AC100P50V-1	0.001UF50WV	C: FXD CER 0.001µF +80, -20% 50V
C79	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C80	CCK-AB100U16V-1	16VB100	C: FXD ELECT 100µF 16V
L91	LCL-T00084-1	*	L: FXD Coil
J95	JCB-AD030PX01-1	PBRS-30P	Connector
J96	JCR-AB040PX01-1	HIF3-40P-2.54DS	Connector
S101	DST-000773-1	5003-K-90°CB	Thermostat

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1	SIA-5534A-1	NE5534AN	IC: Low Noise Operational Amplifier
IC2	SIA-5534A-1	NE5534AN	IC: Low Noise Operational Amplifier
IC3	SIA-DA7524-2	AD7524KN	IC: 8-bit Buffered Multiplying DA Convertor
IC4	SIA-TL072-1	TL072CP	IC: Operational Amplifier
IC5			Not assigned
IC6	SIA-TL072-1	TL072CP	IC: Operational Amplifier
IC7 thru IC9			Not assigned
IC10	SIT-74LS138-9	SN74LS138N	IC: Decoder/Demultiplexer Low Power
IC11	SIA-324-1	LM324	IC: Quadruple Operational Amplifier
IC12	SIT-74LS273	SN74LS273N	IC: Octal D-Type Flip Flop Low Power
IC13 thru IC15	SIA-254-1	UPC254A	IC: Precision Operational Amplifier
IC16	SIA-DA7542-1	AD7542KN	IC: 12-bit DA Convertor
IC17	SIA-DG201-1	DG201BK	IC: Quad Monolithic SPST CMOS Analog Switch
IC18	SIT-74LS04	SN74LS04N	IC: Hex Inverter Low Power
IC19	SIA-DA7524-2	AD7524KN	IC: 8-bit Buffered Multiplying DA Convertor
IC20	SIT-74LS273	SN74LS273N	IC: Octal D-Type Flip Flop Low Power
IC21	SIT-7417	SN7417N	IC: Hex Buffer/Driver with Open Collector High Voltage Output
IC22	SIT-74LS02	SN74LS02	IC: Quadruple 2-Input Positive NOR Gate Low Power
IC23	SIT-74LS14-9	SN74LS14N	IC: Hex Schmitt-Trigger Inverter Low Power
IC24	SIT-74LS273	SN74LS273N	IC: Octal D-Type Flip Flop Low Power
IC25	SIA-254-2	OP-05CJ	IC: Precision Operational Amplifier
IC26	SIA-DG201-1	DG201BK	IC: Quad Monolithic SPST CMOS Analog Switch
IC27	SIA-254-1	UPC254A	IC: Precision Operational Amplifier
IC28	SIA-DG201-1	DG201BK	IC: Quad Monolithic SPST CMOS Analog Switch
IC29	SIA-5534A-1	NE5534AN	IC: Low Noise Operational Amplifier
IC30	SIT-74LS273	SN74LS273N	IC: Octal D-Type Flip Flop Low Power
Q36	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
D41	SDS-1SS97-1	1SS97	Diode SI
D42	SDS-1SS97-1	1SS97	Diode SI
D43	SDZ-6-1	LM399H	Zener Diode
D44	SDS-1SS97-1	1SS97	Diode SI
R51	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R52	RMF-AE5KBG-1	RN60E5KΩB	R: FXD Metal FLM 5kΩ ±0.1% 1/8W
R53	RMF-AE15KFG-1	RN60E15KΩF	R: FXD Metal FLM 15kΩ ±1% 1/8W
R54	RMF-AE7R5KFK-1	RN60J7.5KΩF	R: FXD Metal FLM 7.5kΩ ±1% 1/8W
R55	RMF-AE1KBG-1	RN60E1KΩB	R: FXD Metal FLM 1kΩ ±0.1% 1/8W
R56	RCB-AH5R1K-1	RD25S 5.1KΩJ	R: FXD CAR 5.1kΩ ±5% 1/4W
R57 thru R60			Not assigned

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R61 thru R64	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R65	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R66 thru R69			Not assigned
R70	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R71	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R72	RCB-AH6R8K-1	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R73	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R74	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R75	RMF-AE10KBG-1	RN60E10KΩB	R: FXD Metal FLM 10kΩ ±0.1% 1/8W
R76	RMF-AE10KBG-1	RN60E10KΩB	R: FXD Metal FLM 10kΩ ±0.1% 1/8W
R77	RMF-AE1KBG-1	RN60E1KΩB	R: FXD Metal FLM 1kΩ ±0.1% 1/8W
R78	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R79	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R80	RMF-AE10KBG-1	RN60E10KΩB	R: FXD Metal FLM 10kΩ ±1% 1/8W
R81	RMF-AR10QFK-1	SN14K2E10ΩF	R: FXD Metal FLM 10Ω ±1% 1/4W
R82	RMF-AE110QBG-1	RN60E110ΩB	R: FXD Metal FLM 110Ω ±0.1% 1/8W
R83	RMF-AE1KBG-1	RN60E1KΩB	R: FXD Metal FLM 1kΩ ±0.1% 1/8W
R84	RMF-AE10KBG-1	RN60E10KΩB	R: FXD Metal FLM 10kΩ ±0.1% 1/8W
R85	RMF-AE8KBG-1	RN60E8KΩB	R: FXD Metal FLM 8kΩ ±0.1% 1/8W
R86	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R87	RMF-AR4R7KFK-1	SN14K2E4.7KΩF	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R88	RMF-AR4R7KFK-1	SN14K2E4.7KΩF	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R89	RMF-AB4R4KFG-1	RF1/4N4.4KΩRF	R: FXD Metal FLM 4.4kΩ ±1% 1/4W
R90	RMF-AB1R8KFJ-1	RF1/4N1.8KΩSF	R: FXD Metal FLM 1.8kΩ ±1% 1/4W
R91	RMF-AR1R5KFK-1	SN14K2E1.5KΩF	R: FXD Metal FLM 1.5kΩ ±1% 1/4W
R92	RMF-AR7R5KFK-1	SN14K2E7.5KΩF	R: FXD Metal FLM 7.5kΩ ±1% 1/4W
R93	RVR-BD1K-1	X6S1KΩ	R: VAR WW 1kΩ
R94	RVR-BD2K-1	X6S2KΩ	R: VAR WW 2kΩ
R95	RVR-BD2K-1	X6S2KΩ	R: VAR WW 2kΩ
R96			Not assigned
R97			Not assigned
R98	RVR-BD200-1	X6S200Ω	R: VAR WW 200Ω
R99	RVR-BE10K-1	X6T10KΩ	R: VAR WW 10kΩ
R100	RVR-BE500-1	X6T500Ω	R: VAR WW 500Ω
R101	RVR-BD2K-1	X6S2KΩ	R: VAR WW 2kΩ
R102	RMF-AR100KFK-1	SN14K2E100KΩF	R: FXD Metal FLM 100kΩ ±1% 1/4W
R103 thru R106			Not assigned
R107	RCB-AH22K-1	RD25S22KΩJ	R: FXD CAR 22kΩ ±5% 1/4W
R108	RVR-CD100K-1	RJ6X100KΩ	R: VAR CERMET 100kΩ
C110			Not assigned
C111 thru C117	CTA-AC1U50V-1	242M5002-105M	C: FXD ELECT TANTAL 1μF ±20% 50V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C118	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.22µF +80, -20% 50V
C119	CCK-AA100U25V-1	25T100	C: FXD ELECT 100µF 25V
C120	CTA-AC1U50V-1	242M5002-105M	C: FXD ELECT TANTAL 1µF ±20% 50V
C121 thru C124	CCK-AA100U25V-1	25T100	C: FXD ELECT 100µF 25V
C125	CTA-AC1U50V-1	242M5002-105M	C: FXD ELECT TANTAL 1µF ±20% 50V
C126	CTA-AC1U50V-1	242M5002-105M	C: FXD ELECT TANTAL 1µF ±20% 50V
C127	CCK-AA220U10V-1	10T220	C: FXD ELECT 220µF 10V
C128	CCK-AA220U10V-1	10T220	C: FXD ELECT 220µF 10V
C129 thru C134	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022µF +80, -20% 50V
C135			Not assigned
C136			Not assigned
C137	CSM-ACR022U50V-1	0.022µF50WV	C: FXD CER 0.022µF +80, -20% 50V
C138	CSM-ACR022U50V-1	0.022µF50WV	C: FXD CER 0.022µF +80, -20% 50V
C139 thru C141			Not assigned
C142 thru C164	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022µF +80, -20% 50V
C165			Not assigned
C166 thru C168	CSM-AC33P50V-1	33PF50WV	C: FXD CER 33pF ±10% 50V
C169	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1µF +80, -20% 50V
C170	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001µF +80, -20% 50V
L171	LCL-C00014-1	CSL0812-471J	L: FXD Coil
L172	LCL-C00014-1	CSL0812-471J	L: FXD Coil
L173	LCL-T00084-1	*	L: FXD Coil
J191	JCF-AC001JX01-1	UM-LR-PC	Connector
J192	JCP-AA003PX05-1	A-1103	Connector
J193			Not assigned
J194	JCR-AF020PX02-1	HIF3F-20P-2.54DS	Connector
J195	JCR-AF020PX02-1	HIF3F-20P-2.54DS	Connector
J196	JCP-AA003PX06-1	A-1303	Connector

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1	SIT-7416	SN7416N	IC: Hex Inverter Buffer/Driver with Open-Collector High-Voltage Output
IC2	SIT-74LS174	SN74LS174N	IC: Hex D-Type Flip Flop Low Power
IC3	SIT-74LS273	SN74LS273N	IC: Octal D-Type Flip Flop Low Power
IC4	SIT-74LS02	SN74LS02N	IC: Quadruple 2-Input Positive-NOR Gate Low Power
IC5	SIT-74LS74	SN74LS74N	IC: Dual D-Type Positive-Edge-Triggered Flip Flop with Preset AND Clear Low Power
IC6	SIT-74LS04	SN74LS04N	IC: Hex Inverter Low Power
IC7	SIT-74LS244	SN74LS244N	IC: Octal Buffer/Line Driver/Line Receiver Low Power
IC8	SIA-339-1	LM339	IC: Quad Comparator
IC9	SIT-74LS138	SN74LS138N	IC: 3-to-8 Line Decoder/Multiplexer Low Power
IC10	SIT-74LS14	SN74LS14N	IC: Hex Schmitt-Trigger Inverter Low Power
IC11	SIA-339-1	LM339	IC: Quad Comparator
IC12	SIT-74LS26	SN74LS26	IC: Quadruple 2-Input High-Voltage Interface Low Power
IC13	SIT-7416	SN7416N	IC: Hex Inverter Buffer/Driver with Open-Collector High-Voltage Output
IC14	SIT-74LS174	SN74LS174N	IC: Hex D-Type Flip Flop Low Power
IC15	SIA-324-1	LM324	IC: Quadruple Operational Amplifier
IC16	SIA-DG201-1	DG201BK	IC: Quad Monolithic SPST CMOS Analog Switch
IC17	SIT-74LS04	SN74LS04N	IC: Hex Inverter Low Power
IC18	SIT-74LS30	SN74LS30N	IC: 8-Input Positive-NAND Gate Low Power
IC19	SIT-74LS00	SN74LS00N	IC: Quadruple 2-Input Positive-NAND Gate Low Power
IC20	SIT-74LS174	SN74LS174N	IC: Hex D-Type Flip Flop Low Power
IC21	SIA-339-1	LM339	IC: Quad Comparator
IC22	SIT-74LS02	SN74LS02N	IC: Quadruple 2-Input Positive-NOR Gate Low Power
IC23	SIT-74LS02	SN74LS02N	IC: Quadruple 2-Input Positive-NOR Gate Low Power
IC24	SIA-324-1	LM324	IC: Quadruple Operational Amplifier
IC25	SIA-324-1	LM324	IC: Quadruple Operational Amplifier
IC26	SIT-74LS273	SN74LS273N	IC: Octal D-Type Flip Flop Low Power
IC27	SIT-74LS244	SN74LS244N	IC: Octal Buffer/Line Driver/Line Receiver Low Power
IC28	SIT-74LS273	SN74LS273N	IC: Octal D-Type Flip Flop Low Power
IC29	SIT-74LS374	SN74LS374N	IC: Octal D-Type Flip Flop Low Power
IC30	SIA-319-1	LM319H	IC: High Speed Dual Comparator
IC31	SIA-TL082-1	TL082CP	IC: Dual Operational Amplifier
IC32	SIA-TL082-1	TL082CP	IC: Dual Operational Amplifier
Q41	STN-2SC1834-1	2SC1834	Transistor SI NPN
D51	SDS-1S953-1	1S953	Diode SI
R61	RCB-AH15K-1	RD25S15KΩJ	R: FXD CAR 15kΩ ±5% 1/4W
R62 thru R64	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R65	RCB-AH15K	RD25S15KΩJ	R: FXD CAR 15kΩ ±5% 1/4W
R66	RCB-AH68K	RD25S68KΩJ	R: FXD CAR 68kΩ ±5% 1/4W
R67	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R68	RCB-AH100	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R69	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R70	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R71 thru R73	RCB-AH2R2K	RD25S2R2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R74 thru R76	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R77	RCB-AH1R2K-1	RD25S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/4W
R78	RCB-AH15K	RD25S15KΩJ	R: FXD CAR 15kΩ ±5% 1/4W
R79	RCB-AH2R2K	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R80	RCB-AH12K	RD25S12KΩJ	R: FXD CAR 12kΩ ±5% 1/4W
R81	RCB-AH150	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R82	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R83	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R84	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R85	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R86	RCB-AH3R3K	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R87	RCB-AH1K	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R88	RCB-AH10K	RD25S10KΩJ	R: FXC CAR 10kΩ ±5% 1/4W
R89	RCB-AH2R2K	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R90	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R91	RCB-AH4R7K	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R92	RCB-AH1K	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R93	RCB-AH2R2K	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R94	RCB-AH12K	RD25S12KΩJ	R: FXD CAR 12kΩ ±5% 1/4W
R95	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R96	RVR-BD5K-1	X6S5KΩ	R: VAR WW 5kΩ
R97	RCB-AH100K	RD25S100KΩJ	R: FXD CAR 100kΩ ±5% 1/4W
R98	RCB-AH100K	RD25S100KΩJ	R: FXD CAR 100kΩ ±5% 1/4W
C101 thru C105	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022µF +80, -20% 50V
C106	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047µF +80, -20% 50V
C107	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047µF +80, -20% 50V
C108 thru C119	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022µF +80, -20% 50V
C120	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C121	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022µF +80, -20% 50V
C122 thru C130	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C131	CTA-AC1U50V-1	242M5002-105M	C: FXD ELECT TANTAL 1µF ±20% 50V
C132	CCK-AA100U25V-1	25T100	C: FXD ELECT 100µF 25V
C133	CCK-AA100U25V-1	25T100	C: FXD ELECT 100µF 25V
C134	CTA-AC1U50V-1	242M5002-105M	C: FXD ELECT TANTAL 1µF ±20% 50V
C135	CCK-AA100U25V-1	25T100	C: FXD ELECT 100µF 25V
C136	CCK-AA100U25V-1	25T100	C: FXD ELECT 100µF 25V
C137	CCK-AA220U10V-1	10T220	C: FXD ELECT 220µF 10V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C138	CCK-AA220U10V-1	10T220	C: FXD ELECT 220uF 10V
C139 thru C143	CTA-AC1U50V-1	242M5002-105M	C: FXD ELECT TANTAL 1uF ±20% 50V
PL161	KRL-000293-1	NR-H-12V	Reed Relay
R165	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R166	RCB-AH22K-1	RD25S22KΩJ	R: FXD CAR 22kΩ ±5% 1/4W
R167	RVR-BD5K-1	X6S5KΩ	R: VAR WW 5kΩ
L171	LCL-C00014-1	CSL0812-471J	L: FXD Coil
L172	LCL-C00014-1	CSL0812-471J	L: FXD Coil
L173	LCL-T00084-1	*	L: FXD Coil
J181	JCR-AF030PX02-1	HIF3F-30P-2.54DS	Connector
J182	JCR-AF010PX02-1	HIF3F-10P-2.54DS	Connector
J183	JCP-AA006PX03-1	A-1306	Connector
J184	JCR-AF020PX02-1	HIF3F-20P-2.54DS	Connector

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1	SIA-356-1	LF356H	IC: Junction FET INPUT Type Operational Amplifier
IC2	SIA-356-1	LF356H	IC: Junction FET INPUT Type Operational Amplifier
IC3 thru IC5	SIA-5534A-1	NE5534AN	IC: Low Noise Operational Amplifier
IC6	SIA-356-1	LF356H	IC: Junction FET INPUT Type Operational Amplifier
IC7	SIA-254-1	UPC254A	IC: Precision Operational Amplifier
IC8	SIA-254-1	UPC254A	IC: Precision Operational Amplifier
IC9	SIA-356-1	LF356H	IC: Junction FET INPUT Type Operational Amplifier
IC10	SIA-DA7542-1	AD7542KN	IC: 12-bit DA Convertor
IC11	SIT-74LS02-1	SN74LS02N	IC: Quadruple 2-Input NOR Gate Low Power
IC12	SIT-74LS174-1	SN74LS174N	IC: Hex D Type Flip Flop Low Power
IC13	SIT-74LS174-1	SN74LS174N	IC: Hex D Type Flip Flop Low Power
IC14	SIT-74LS273-1	SN74LS273N	IC: Octal D-Type Flip Flop Low Power
IC15	SIA-DA7524-2	AD7524KN	IC: 8-bit Buffered Multiplying DA Convertor
IC16	SIT-74LS14-1	SN74LS14N	IC: Hex Schmitt-Trigger Inverter Low Power
IC17	SIT-74LS138-1	SN74LS138N	IC: 3-to-8 Line Decoder/Multiplexer Low Power
IC18 thru IC20	SIA-324-1	LM324	IC: Quadruple Operational Amplifier
IC21	SIA-DA7524-2	AD7524KN	IC: 8-bit Buffered Multiplying DA Convertor
	JCI-AD016JX01-2	DL2-16A	IC Socket
Q25	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
D31	SDZ-1S2191-2	1S2192	Diode SI
D32 thru D34	SDS-1SS97-1	1SS97	Diode SI
R41	RMF-AR100QFK-1	SN14K2E100ΩF	R: FXD Metal FLM 100Ω ±1% 1/4W
R42	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R43	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R44	RMF-AR5KFK-1	SN14K2E5KΩF	R: FXD Metal FLM 5kΩ ±1% 1/4W
R45	RMF-AR5R6KFK-1	SN14K2E5.6KΩF	R: FXD Metal FLM 5.6kΩ ±1% 1/4W
R46	RMF-AR4R7KFK-1	SN14K2E4.7KΩF	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R47	RMF-AR4R7KFK-1	SN14K2E4.7KΩF	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R48	RMF-AR6R2KFK-1	SN14K2E6.2KΩF	R: FXD Metal FLM 6.2kΩ ±1% 1/4W
R49	RMF-AR4R7KFK-1	SN14K2E4.7KΩF	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R50	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R51	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R52	RMF-AR56QFK-1	SN14K2E56ΩF	R: FXD Metal FLM 56Ω ±1% 1/4W
R53	RMF-AR100QFK-1	SN14K2E100ΩF	R: FXD Metal FLM 100Ω ±1% 1/4W
R54 thru R56	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R57	RMF-AR22KFK-1	SN14K2E22KΩF	R: FXD Metal FLM 22kΩ ±1% 1/4W
R58	RMF-AR4R7KFK-1	SN14K2E4.7KΩF	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R59	RMF-AR5R6KFK-1	SN14K2E5.6KΩF	R: FXD Metal FLM 5.6kΩ ±1% 1/4W
R60	RMF-AR4R7KFK-1	SN24K2E4.7KΩF	F: FXD Metal FLM 4.7kΩ ±1% 1/4W
R61	RMF-AR6R2KFK-1	SN14K2E6.2KΩF	R: FXD Metal FLM 6.2kΩ ±1% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R62	RMF-AR56QFK-1	SN14K2E56ΩF	R: FXD Metal FLM 56Ω ±1% 1/4W
R63	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R64	RMF-AR10QFK-1	SN14K2E10ΩF	R: FXD Metal FLM 10Ω ±1% 1/4W
R65	RMF-AR20KFK-1	SN14K2E20KΩF	R: FXD Metal FLM 20kΩ ±1% 1/4W
R66	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R67	RMF-AR6R2KFK-1	SN14K2E6.2KΩF	R: FXD Metal FLM 6.2kΩ ±1% 1/4W
R68	RMF-AR680QFK-1	SN14K2E680ΩF	R: FXD Metal FLM 680Ω ±1% 1/4W
R69	RMF-AR1R2KFK-1	SN14K2E1.2KΩF	R: FXD Metal FLM 1.2kΩ ±1% 1/4W
R70	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R71	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R72	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R73	RMF-AR10QFK-1	SN14K2E10ΩF	R: FXD Metal FLM 10Ω ±1% 1/4W
R74	RMF-AR20KFK-1	SN14K2E20KΩF	R: FXD Metal FLM 20kΩ ±1% 1/4W
R75	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R76	RMF-AR1KFK-1	SN14K2E1KΩF	R: FXD Metal FLM 1kΩ ±1% 1/4W
R77	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R78	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R79	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
VR85	RVR-BE20K-1	X6T20KΩ	R: VAR WW 20kΩ
VR86	RVR-BE2K-1	X6T2KΩ	R: VAR WW 2kΩ
VR87 thru VR89	RVR-BE1K-1	X6T1KΩ	R: VAR WW 1kΩ
VR90	RVR-BE2K-1	X6T2KΩ	R: VAR WW 2kΩ
VR91	RVR-BE20K-1	X6T20KΩ	R: VAR WW 20kΩ
VR92	RVR-BE2K-1	X6T2KΩ	R: VAR WW 2kΩ
VR93 thru VR95	RVR-BE1K-1	X6T1KΩ	R: VAR WW 1kΩ
VR96	RVR-BE2K-1	X6T2KΩ	R: VAR WW 2kΩ
VR97	RVR-BE1K-1	X6T1KΩ	R: VAR WW 1kΩ
VR98	RVR-BE2K-1	X6T2KΩ	R: VAR WW 2kΩ
C105 thru C132	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022µF +80, -20% 50V
C133 thru C142	CTA-AC1U50V-1	242M5002-105M	C: FXD ELECT TANTAL 1µF ±20% 50V
C143 thru C147	CCK-AA100U25V-1	25T100	C: FXD ELECT 100µF 25V
C148	CCK-AA220U10V-1	10T220	C: FXD ELECT 220µF 10V
C149	CCK-AA220U10V-1	10T220	C: FXD ELECT 220µF 10V
C150 thru C152	CSM-AC33P50V-1	33PF50WV	C: FXD CER 33pF ±10% 50V
C153	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001µF +80, -20% 50V
L155	LCL-C00014-1	CSL0812-471J	L: FXD Coil
L156	LCL-C00014-1	CSL0812-471J	L: FXD Coil
L157	LCL-T00084-1	*	L: FXD Coil

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
J165	JCF-AC001JX01-1	UM-LR-PC	Connector
J166	JCF-AC001JX01-1	UM-LR-PC	Connector
J167	JCR-AF016PX02-1	HIF3F-16P-2.54DS	Connector
J168	JCR-AF010PX02-1	HIF3F-10P-2.54DS	Connector
J169	JCP-AA003PX06-1	A-1303	Connector
	DCB-SS1137X01-1	*	Cable

TR4172
RF KEY BLOCK (MEP-352)
BLN-010222

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
D1 thru D9	NLD-000003-1	BR3402S	Light Emitting Diode
J12	JCR-AF020PX01-1	HIF3F-20P-2.54DSA	Connector
S15 thru S26	KSP-000250-1	1KSR001-00081-000	Push Switch

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
ATT1	DHB-000634-1	*	Attenuator
ATT2	DHB-000635-1	*	Attenuator
R1	RVR-BA10K-1	X13B10KΩ	R: VAR WW 10kΩ
R2			Not assigned
R3	RVR-BL10K-1	RV16YN15SB10KΩ	R: VAR CERMET 10kΩ
J5	JCF-AA001JX07-1	HRM511	Connector
J6	JCF-AF001JX05-1	*	Connector
J7	JCS-AV004JX01-1	RA0304	Connector
J8			Not assigned
S11	KSP-000360-1	F02EE01	Push Switch
S12	KSP-000032-1	*	Switch
S13	KSP-000032-1	*	Switch
D15	NLD-000002-1	BD-703G	Light Emitting Diode
D16	NLD-000001-1	BD-701R	Light Emitting Diode
P38	JTT-AA010EX01-2	RGKS-10B	Lug

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1	SIA-A11-1	WJ-A11	IC: Cascadable Amplifier
IC2	SIA-A15-1	WJ-A15	IC: Cascadable Amplifier
C4	CCP-ADR1U50V-1	C3225Y5V1H104Z	C: FXD CHIP 0.1µF +80, -20% 50V
C5	CTA-AC1U50V-1	242M5002-105M	C: FXD ELECT TANTAL 1µF ±20% 50V
L11	LCL-B000376-1	TPF0410-331K	L: FXD Coil
CBL13	DCB-FF0934X04-1	*	Cable
CBL14	DCB-FF0934X11-1	*	Cable
CBL16	DCB-FF0934X20-1	*	Cable
S15	KSP-000032-1	*	Switch
R23	DHB-000332-1	THP-007-3	R: PAD
J25	JCF-AB001JX11-2	3CR	Coaxial Connector
J26	JCF-AA001JX20-2	50-645-4526-89	Coaxial Connector
FL30	DNF-000601-1	ZFN5101-01R	Filter
D17	SDS-1SS97-1	1SS97	Diode SI
D18	SDS-1SS97-1	1SS97	Diode SI

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R27			Not assigned
P31			Not assigned
C35	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1UF +80, -20% 50V
	RHB-000006-1	*	Coupler
	SiA-CGB204000-1	*	2 - 4GHz High Power Amplifier
	DXY-000498-1	*	YIG TUNED Oscillator

TR4172
YIG OSCILLATOR DRIVER
BLC-010224

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1	SIA-254-2	OP-05CJ	IC: Precision Operational Amplifier
IC2	SIA-254-2	OP-05CJ	IC: Precision Operational Amplifier
IC3	SIA-5534A-1	NE5534AN	IC: Low Noise Operational Amplifier
IC4	SIA-DG201-1	DG201BK	IC: Quad Monolitbic SPST CMOS Analog Switch
IC5	SIA-7812U-3	FS7812M	IC: Voltage Regulator
IC6	SIA-7905U-3	FS7905M	IC: Voltage Regulator
IC7	SIA-TL082-1	TL082CP	IC: Dual Operational Amplifier
IC8	SIA-TL082-1	TL082CP	IC: Dual Operational Amplifier
Q11 thru Q13	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q14	STP-2SA1015-1	2SA1015	Transistor SI PNP
Q15	STN-2SC1173-1	2SC1173	Transistor SI NPN
Q16	STN-2SC1173-1	2SC1173	Transistor SI NPN
Q17 thru Q20	STP-2SA1015-1	2SA1015	Transistor SI PNP
Q21	SFN-2N4859-18	2N4859	Transistor SI PNP
Q22	STN-2SC1173-1	2SC1173	Transistor SI NPN
Q23	SFN-2N4859-18	2N4859	Transistor SI PNP
D29	SDS-LD1-1	LD-1	Diode SI
D30	SDZ-W100-1	WZ-100	Zener Diode
D31	SDS-LD-1	LD-1	Diode SI
D32	SDS-1S953-1	1S953	Diode SI
D33	SDS-1S953-1	•1S953	Diode SI
D34	SDZ-W120-1	WZ120	Zener Diode
D35	SDZ-W120-1	WZ120	Zener Diode
D36	SDS-1S953-1	1S953	Diode SI
D37	SDZ-D043-1	RD-4.3F	Diode SI
D38 thru D40	SDS-1S953-1	1S953	Diode SI
R41	RMF-AE4KAG-1	RN60E4KΩA	R: FXD Metal FLM 4kΩ ±0.05% 1/8W
R42	RVR-AH500-1	K9W500Ω	R: VAR WW 500Ω
R43	RMF-AE4R7KFG-1	RN60E4.7KΩF	R: FXD Metal FLM 4.7kΩ ±1% 1/8W
R44	RMF-AR4R7KFK-1	SN14K2E4.7KΩF	R: FXD Metal FLM 4.7kΩ ±1% 1/8W
R45	RMF-AR4R7KFK-1	SN14K2E4.7KΩF	R: FXD Metal FLM 4.7kΩ ±1% 1/8W
R46	RVR-BE10K-1	X6T10KΩ	R: VAR WW 10kΩ
R47	RMF-AR2R2KFK-1	SN14K2E2.2KΩF	R: FXD Metal FLM 2.2kΩ ±1% 1/4W
R48	RPW-AC55	RH10-55ΩJ	R: VAR WW 55Ω
R49	RMF-AE10KBG-1	RN60E10KΩB	R: FXD Metal FLM 10kΩ ±0.1% 1/8W
R50	RMF-AE10KBG-1	RN60E10KΩB	R: FXD Metal FLM 10kΩ ±0.1% 1/8W
R51	RMF-AR4R7KFK-1	SN14K2E4.7KΩF	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R52	RMF-AR4R7KFK-1	SN14K2E4.7KΩF	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R53	RVR-BE10K-1	X6T10KΩ	R: VAR WW 10kΩ
R54	RMF-AR5KFK-1	SN14K2E5KΩF	R: FXD Metal FLM 5kΩ ±1% 1/4W
R55	RPW-AR55-1	AL10-55Ω	F: VAR WW 55Ω
R56	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R57	RMF-AR20KFK-1	SN14K2E20KΩF	R: FXD Metal FLM 20kΩ ±1% 1/4W

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Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R58	RMF-AR12KFK-1	SN14K2E12KΩF	R: FXD Metal FLM 12kΩ ±1% 1/4W
R59	RVR-BE10K-1	X6T10KΩ	R: VAR WW 10kΩ
R60	RMF-AR4R7KFK-1	SN14K2E4.7KΩF	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R61	RMF-AR4R7KFK-1	SN14K2E4.7KΩF	R: FXD Metal FLM 4.7kΩ ±1% 1/4W
R62	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±1% 1/4W
R63	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R64	RVR-BE5K-1	X6T5KΩ	R: VAR WW 5kΩ
R65	RMF-AS100QFK-1	SN14K2H100ΩF	R: FXD Metal FLM 100Ω ±1% 1/2W
R66	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R67	RCB-AH100K-1	RD25S100KΩJ	R: FXD CAR 100kΩ ±5% 1/4W
R68	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R69	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R70	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R71	RCB-AH100K-1	RD25S100KΩJ	R: FXD CAR 100kΩ ±5% 1/4W
R72	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R73	RCB-AH10-1	RD25S10ΩJ	R: FXD CAR 10Ω ±5% 1/4W
R74 thru R77			Not assigned
R78	RCB-AH820K	RD25S820KΩJ	R: FXD CAR 820kΩ ±5% 1/4W
R79	RCB-AH10K	RD25S10KΩ	R: FXD CAR 10kΩ ±5% 1/4W
R80	RCB-AH820K	RD25S820KΩJ	R: FXD CAR 820kΩ ±5% 1/4W
C81	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C82	CCK-AB100U25V-1	25VB100	C: FXD ELECT 100μF 25V
C83	CCK-AB100U25V-1	25VB100	C: FXD ELECT 100μF 25V
C84	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C85	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C86	CTA-AB2R2U35V-1	221M3502-225M	C: FXD ELECT TANTAL 2.2μF ±20% 35V
C87	CCK-AB100U25V-1	25VB100	C: FXD ELECT 100μF 25V
C88	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C89	CTA-AA68U25V-1	111M2502-686M	C: FXD ELECT TANTAL 68μF ±20% 25V
C90	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C91	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C92	CFM-AB4700P50V-1	501N5002-472K	C: FXD Mylar 4700pF ±10% 50V
C93	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C94	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C95 thru C99	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C100	CCK-AB100U25V-1	25VB100	C: FXD ELECT 100μF 25V
C101	CCK-AB100U25V-1	25VB100	C: FXD ELECT 100μF 25V
C102	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C103	CSM-ACR1U50V-1	0.1UF50WV	C: FXD CER 0.1μF +80, -20% 50V
C104	CTA-AB2R2U35V-1	221M3502-225M	C: FXD ELECT TANTAL 2.2μF ±20% 35V
C105	CCK-AB100U25V-1	25VB100	C: FXD ELECT 100μF 25V
C106	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C107	CCK-AA220U10V-1	10T220	C: FXD ELECT 220μF 10V
C108	CCK-AA1000U10V-1	10T1000	C: FXD ELECT 1000μF 10V
C109	CCK-AB100U25V-1	25VB100	C: FXD ELECT 100μF 25V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C110	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C111	CFM-AB6800P50V-1	501N5002-682K	C: FXD Mylar 6800pF ±10% 50V
C112	CFM-ABR1U50V-1	501N5002-104K	C: FXD Mylar 0.1μF ±10% 50V
C113	CFM-ABR022U50V-1	501N5002-223K	C: FXD Mylar 0.022μF ±10% 50V
C114	CFM-ABR047U50V-1	501N5002-473K	C: FXD Mylar 0.047μF ±10% 50V
C115 thru C117	CSM-ACR022U50V-1	0.022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C118	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10μF 25V
C119	CTA-AE1U35V-1	NP35ST1R0	C: FXD ELECT TANTAL 1μF 35V
L121	LCL-C00013-1	CSL0812-181J	L: FXD Coil
L122	LCL-C00013-1	CSL0812-181J	L: FXD Coil
L123	LCL-C00014-1	CSL0812-471J	L: FXD Coil
R124	RCB-AH1M	RD25S1MΩJ	R: FXD CAR 1MΩ ±5% 1/4W
R125	RCB-AH470	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R126	RMF-AR10KFK-1	SN14K2E10KΩF	R: FXD Metal FLM 10kΩ ±5% 1/4W
R127	RCB-AH100K	RD25S100KΩJ	R: FXD CAR 100kΩ ±5% 1/4W
R128	RCB-AH10K	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R129	RCB-AH18K	RD25S18KΩJ	R: FXD CAR 18kΩ ±5% 1/4W
J131	JCP-AA003PX05-1	A-1103	Connector
J132	JCP-AA003PX05-1	A-1103	Connector
J133	JCR-AF020PX02-1	HIF3F-20P-2.54DS	Connector
J134	JCS-AD005PX01-1	PCN6-5PA-2.5DS	Connector
R135	RCB-AH390K	RD25S390KΩJ	R: FXD CAR 390kΩ ±5% 1/4W
R136	RCB-AH820K	RD25S820KΩJ	R: FXD CAR 820kΩ ±5% 1/4W
R137	RCB-AH5R6K	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R138	RCB-AH5R6K	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
FL21 thru FL28	DNF-000601-1	ZFN5101-01R	Filter
FL29			Not assigned
J51 thru J55	JCF-AC001JX02-2	UM-QR	Connector
J56 thru J58			Not assigned
J59	DCB-QR1039X01-1	HIF3-10P-C020HENC	Connector

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1	SIT-74LS04-9	SN74LS04N	IC: Hex Inverter Low Power
IC2	SIT-74LS00-9	SN74LS00N	IC: Quadruple 2-Input NAND Gate Low Power
Q11 thru Q14	STN-2SC1730-1	2SC1730	Transistor SI NPN
R21	RCB-AH8R2K-1	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R22	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R23	RCB-AH330-1	RD25S330ΩJ	R: FXD CAR 330Ω ±5% 1/4W
R24	RCB-AH680-1	RD25S680ΩJ	R: FXD CAR 680Ω ±5% 1/4W
R25	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR100Ω ±5% 1/4W
R26	RCB-AH8R2K-1	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R27	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R28	RCB-AH680-1	RD25S680ΩJ	R: FXD CAR 680Ω ±5% 1/4W
R29	RCB-AH680-1	RD25S680ΩJ	R: FXD CAR 680Ω ±5% 1/4W
R30	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR100Ω ±5% 1/4W
R31	RCB-AH51-1	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R32	RCB-AH1K-1	RD25S1KΩJ	R: FXDCAR 1kΩ ±5% 1/4W
R33	RCB-AH1R2K-1	RD25S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/4W
R34	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R35	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R36	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R37	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
C41 thru C47	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047 μF +80, -20% 50V
C48	CMC-AB3PR5K-2	DM10C030D5	C: FXD DIPPED MICA 3pF ±0.5% 500V
C49	CMC-AB27PR3K-4	DM10D270J3	C: FXD DIPPED MICA 27pF ±5% 300V
C50	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047 μF +80, -20% 50V
C51	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047 μF +80, -20% 50V
C52	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10 μF 25V
C53	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047 μF +80, -20% 50V
C54 thru C59	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10 μF 25V
C60 thru C62	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047 μF +80, -20% 50V
C63	CMC-AB120PR3K-4	DM10D121J3	C: FXD DIPPED MICA 120pF ±5% 300V
C64	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047 μF +80, -20% 50V
C65	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047 μF +80, -20% 50V
L71	LCL-C00010-1	CSL0609-181K	L: FXD Coil
L72	LCL-T00084-1	*	L: FXD Coil
L73	LCL-C00010-1	CSL0609-181K	L: FXD Coil
L74	LCL-T00084-1	*	L: FXD Coil
CF81	DNF-000199-2	SFE10.0MA-M	Filter
CF82	DNF-000199-2	SFE10.0MA-M	Filter
X91	DXD-000136-1	*	Crystal
J101	JCI-AS005JX01-1	5X-203	Connector

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1	SIA-TL082-1	TL082CP	IC: Dual Operational Amplifier
Q11	STN-2SC1730-1	2SC1730	Transistor SI NPN
Q12	SFM-3SK74-1	3SK74	FET Junction N-Channel
Q13	STN-2SC1730-1	2SC1730	Transistor SI NPN
Q14	STN-2SC1730-1	2SC1730	Transistor SI NPN
D21	SDS-1SS97-1	1SS97	Diode SI
D22	SDS-1SS97-1	1SS97	Diode SI
D23	SDZ-1S2191-2	1S2192	Zener Diode
D24	SDS-1S953-1	1S953	Diode SI
R31	RCB-AH8R2K-1	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R32	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R33	RCB-AH680-1	RD25S680ΩJ	R: FXD CAR 680Ω ±5% 1/4W
R34	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R35	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R36	RCB-AH47K-1	RD25S47KΩJ	R: FXD CAR 47kΩ ±5% 1/4W
R37	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R38	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R39	RCB-AH22-1	RD25S22ΩJ	R: FXD CAR 22Ω ±5% 1/4W
R40	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R41	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R42	RCB-AH150-1	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R43	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R44	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R45	RCB-AH150-1	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R46	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R47			Not assigned
R48	RMF-AC220QFJ-1	RF1/8N220ΩSF	R: FXD Metal FLM 220Ω ±1% 1/8W
R49 thru R51			Not assigned
R52	RMF-AC180QFJ-1	RF1/8N180ΩSF	R: FXD Metal FLM 180Ω ±1% 1/8W
R53	RMF-AC30QFJ-1	RF1/8N30ΩSF	R: FXD Metal FLM 30Ω ±1% 1/8W
R54	RMF-AC22QFJ-1	RF1/8N22ΩSF	R: FXD Metal FLM 22Ω ±1% 1/8W
R55 thru R58	RMF-AC15KFJ-1	RF1/8N15KΩSF	R: FXD Metal FLM 15kΩ ±1% 1/8W
R59	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R60	RMF-AC4R7KFJ-1	RF1/8N4.7KΩSF	R: FXD Metal FLM 4.7kΩ ±1% 1/8W
R61	RVR-BD200-1	X6S200Ω	R: VAR WW 200Ω
R62	RMF-AC390FJ-1	RF1/8N390ΩSF	R: FXD Metal FLM 390Ω ±1% 1/8W
R63	RCB-AH10K-1	RD25S10KΩF	R: FXD CAR 10kΩ ±5% 1/4W
R64	RCB-AH10K-1	RD25S10KΩF	R: FXD CAR 10kΩ ±5% 1/4W
R65	RCB-AH820K-1	RD25S820KΩJ	R: FXD CAR 820kΩ ±5% 1/4W
R66	RCB-AH330K-1	RD25S330KΩJ	R: FXD CAR 330kΩ ±5% 1/4W
R67	RCB-AH330K-1	RD25S330KΩJ	R: FXD CAR 330kΩ ±5% 1/4W
C71	CMC-AB10PR5K-6	DM10C100K5	C: FXD DIPPED MICA 10pF ±10% 500V
C72	CMC-AB30PR5K-4	DM10D300J5	C: FXD DIPPED MICA 30pF ±5% 500V

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Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C73 thru C77	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C78	CMC-AB33PR5K-4	DM10D330J5	C: FXD DIPPED MICA 33pF ±5% 500V
C79	CMC-AB1PR5K-2	DM10C010D5	C: FXD DIPPED MICA 1pF ±0.5% 500V
C80	CMC-AB33PR5K-4	DM10D330J5	C: FXD DIPPED MICA 33pF ±5% 500V
C81	CMC-AB1PR5K-2	DM10C010D5	C: FXD DIPPED MICA 1pF ±0.5% 500V
C82	CMC-AB33PR5K-4	DM10D330J5	C: FXD DIPPED MICA 33pF ±5% 500V
C83 thru C86	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C87	CMC-AB33PR5K-4	DM10D330J5	C: FXD DIPPED MICA 33pF ±5% 500V
C88	CMC-AB1PR5K-2	DM10C010D5	C: FXD DIPPED MICA 1pF ±0.5% 500V
C89	CMC-AB33PR5K-4	DM10D330J5	C: FXD DIPPED MICA 33pF ±5% 500V
C90 thru C93	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C94			Not assigned
C95	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C96	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C97			Not assigned
C98	CSM-ACR047U50V-1	0.047UF50WV	C: FAD CER 0.047μF +80 -20% 50V
C99	CSM-AC12P50V-1	12PF50WV	C: FXD CER 12pF ±10% 50V
C100			Not assigned
C101 thru C103	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C104	CTA-AB10U25V-1	221M2502-106M	C: FXD ELECT TANTAL 10μF ±20% 25V
C105 thru C108	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10μF 25V
C109	CSM-AC10P50V-1	10PF50WV	C: FXD CER 10pF ±10% 50V
C110 thru C113	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
L121 thru L126	LCL-C00329-1	*	L: FXD Coil
L127	LCL-B00312-1	TP0410-R56K	L: FXD Coil
L128	LCL-C00010-1	CSL0609-181K	L: FXD Coil
L129	LCL-C00010-1	CSL0609-181K	L: FXD Coil
J141	JCP-AA003PX05-1	A-1103	Connector

TR4172
1st MIXER BLOCK
MEP-343

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
J10 thru J12	JCF-AA001JX20-2	50-645-4526-89	Coaxial Connector
	SHB-000552-1	*	Interface Block

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TR4172
1st MIXER
BTB-010136

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
D1	SDS-DMJ4708-1	*	Diode SI
R11	DHB-000332-1	*	R: 3dB PAD
R12	RCP-AB39-5	MCR18-39ΩK	R: FXD CHIP 39Ω
C25	CCP-AC100P50V-5	C35NP01H101K	C: FXD CHIP 100pF ±10% 50V
	DCB-QQ0936X04-1	MCT219(10mm)	Cable

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
FL1	DNF-000471-1	*	Filter
FL2			Not assigned
FL3 thru FL5	DNF-000471-1	*	Filter
FL6			Not assigned
FL7			Not assigned
FL8 thru FL12	DNF-000471-1	*	Filter
FL13			Not assigned
BP15	DHB-000623-1	*	1.84GHz BPF
J18	JCF-AA001JX20-2	50-645-4526-89	Connector
J19			Not assigned
J20	JCF-AA001JX20-2	50-645-4526-89	Connector
J21 thru J25	JCF-AC001JX02-2	UM-QR	Connector
J26			Not assigned
J27			Not assigned
J28	JCS-AD005PX05-1	PCN6B-5P-2.5E	Connector
J29	DCB-QR1039X02-1	HIF3-10P-C035HENC	Connector

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1	SIA-356-1	LF356H	IC: Junction FET INPUT Type Operational Amplifier
Q11	STN-2SC1254-1	2SC1254	Transistor SI NPN
Q12 thru Q14	STN-2SC2026-1	2SC2026	Transistor SI NPN
Q15	STN-2SC2150-1	2SC2150	Transistor SI NPN
Q16	STN-2SC2150-1	2SC2150	Transistor SI NPN
Q17 thru Q20	STN-2SC1426-1	2SC1426	Transistor SI NPN
Q21	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q22	STN-2SC1426-1	2SC1426	Transistor SI NPN
Q23	STN-2SC1730-1	2SC1730	Transistor SI NPN
Q24	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q25	STN-2SC1426-1	2SC1426	Transistor SI NPN
Q26	STN-2SC1815-1	2SC1815	Transistor SI NPN
Q27	STN-2SC1815-1	2SC1815	Transistor SI NPN
Q28	STN-2SC2026-1	2SC2026	Transistor SI NPN
D44	SDS-SV14-1	1SSV-14B	Diode SI
D45	SDS-1SS97-1	S97	Diode SI
D46	SDS-1SS97-1	1SS97	Diode SI
D47 thru D52			Not assigned
D53 thru D56	SDS-1SS97-1	1SS97-1	Diode SI
D57	SDS-1SV35-1	1SV35	Diode SI
D58 thru D61	SDS-1S953-1	1S953	Diode SI
D62 thru D69	SDS-1S2222-1	1S2222	Diode SI
D70 thru D73	SDS-1SS97-1	1SS97	Diode SI
R91	RCB-AH8R2K-1	RD25S8.2KΩF	R: FXD CAR 8.2kΩ ±5% 1/4W
R92	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R93	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±·% 1/4W
R94	RCB-AH390-1	RD25S390ΩJ	R: FXD CAR 390Ω ±5% 1/4W
R95	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R96	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R97	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R98	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R99	RCB-AH33-1	RD25S33ΩJ	R: FXD CAR 33Ω ±5% 1/4W
R100	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R101	RCB-AH51-1	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R102	RCB-AH22-1	RD25S22ΩJ	R: FXD CAR 22Ω ±5% 1/4W
R103	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R104	RCB-AH22-1	RD25S22ΩJ	R: FXD CAR 22Ω ±5% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R105 thru R107	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R108	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R109	RCB-AH8R2K-1	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R110	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R111	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R112	RCB-AH12K-1	RD25S12KΩJ	R: FXD CAR 12Ω ±5% 1/4W
R113	RCB-AH1R5K-1	RD25S1.5KΩJ	R: FXD CAR 1.5kΩ ±5% 1/4W
R114	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R115	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R116	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R117	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R118	RCB-AH1R5K-1	RD25S1.5KΩJ	R: FXD CAR 1.5kΩ ±5% 1/4W
R119	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R120	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R121	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R122 thru R129			Not assigned
R130	RCB-AH10-1	RD25S10ΩJ	R: FXD CAR 10Ω ±5% 1/4W
R131	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R132	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R133	RCB-AH150-1	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R134 thru R137	RCB-AH22-1	RD25S22ΩJ	R: FXD CAR 22Ω ±5% 1/4W
R138	RCB-AH150-1	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R139	RCB-AH39-1	RD25S39ΩJ	R: FXD CAR 39Ω ±5% 1/4W
R140	RCB-AH150-1	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R141	RCB-AH3R9K-1	RD25S3.9KΩJ	R: FXD CAR 3.9kΩ ±5% 1/4W
R142	RCB-AH3R9K-1	RD25S3.9KΩJ	R: FXD CAR 3.9kΩ ±5% 1/4W
R143	RCB-AH390-1	RD25S390ΩJ	R: FXD CAR 390Ω ±5% 1/4W
R144			Not assigned
R145	RCB-AH33-1	RD25S33ΩJ	R: FXD CAR 33Ω ±5% 1/4W
R146	RCB-AH8R2K-1	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R147	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R148	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R149	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R150	RCB-AH47-1	RD25S47ΩJ	R: FXD CAR 47Ω ±5% 1/4W
R151	RVR-BE20-1	X6T 20Ω	R: VAR WW 20Ω
R152	RCB-AH51-1	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R153	RCB-AH270-1	RD25S270ΩJ	R: FXD CAR 270Ω ±5% 1/4W
R154	RCB-AH27K-1	RD25S27KΩJ	R: FXD CAR 27kΩ ±5% 1/4W
R155	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R156 thru R158	RCB-AH15K-1	RD25S15KΩJ	R: FXD CAR 15kΩ ±5% 1/4W
R159	RCB-AH100K-1	RD25S100KΩJ	R: FXD CAR 100kΩ ±5% 1/4W
R160	RCB-AH6R8K-1	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R161	RCB-AH3R9K-1	RD25S3.9KΩJ	R: FXD CAR 3.9kΩ ±5% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R162	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R163	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R164	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R165	RCB-AH680-1	RD25S680ΩJ	R: FXD CAR 680Ω ±5% 1/4W
R166	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R167	RCB-AH1R5K-1	RD25S1.5KΩJ	R: FXD CAR 1.5kΩ ±5% 1/4W
R168 thru R173	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R174	RCB-AH10-1	RD25S10ΩJ	R: FXD CAR 10Ω ±5% 1/4W
R175	RCB-AH51-1	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R176	RCB-AH10-1	RD25S10ΩJ	R: FXD CAR 10Ω ±5% 1/4W
R177 thru R182	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R183 thru R186	RCB-AH33-1	RD25S33ΩJ	R: FXD CAR 33Ω ±5% 1/4W
R187	RCB-AH3R9K-1	RD25S3.9KΩJ	R: FXD CAR 3.9kΩ ±5% 1/4W
R188	RCB-AH3R9K-1	RD25S3.9KΩJ	R: FXD CAR 3.9kΩ ±5% 1/4W
R189	RCB-AH270-1	RD25S270ΩJ	R: FXD CAR 270Ω ±5% 1/4W
R190	RCB-AH51-1	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R191	RCB-AH10-1	RD25S10ΩJ	R: FXD CAR 10Ω ±5% 1/4W
R192	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R193	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R194	RCB-AH1R8K-1	RD25S1.8KΩJ	R: FXD CAR 1.8kΩ ±5% 1/4W
R195	RCB-AH8R2K-1	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R196	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R197	RCB-AH22-1	RD25S22ΩJ	R: FXD CAR 22kΩ ±5% 1/4W
R198	RCB-AH330-1	RD25S330ΩJ	R: FXD CAR 330Ω ±5% 1/4W
R199	RCB-AH1R8K-1	RD25S1.8KΩJ	R: FXD CAR 1.8kΩ ±5% 1/4W
R200	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R201	RCB-AH10-1	RD25S10ΩJ	R: FXD CAR 10Ω ±5% 1/4W
R202	RCB-AH8R2K-1	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R203	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R204	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R205	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R206	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R207	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R208	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R209	RCB-AH8R2K-1	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R210	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R211	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R212	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R213	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R214	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R215	RCB-AH330-1	RD25S330ΩJ	R: FXD CAR 330Ω ±5% 1/4W
R216	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R217	DHB-000332-1	THP-007-3	R: FXD PAD
R218	RCB-AH10-1	RD25S10ΩJ	R: FXD CAR 10Ω ±5% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R219	RCB-AH51-1	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R220	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R221	RVR-BE50-1	X6T50Ω	R: VAR 50Ω
R222	DSP-000014-1	14D46	Thermistor
R223	DSP-000014-1	14D46	Thermistor
C231	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C232	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C233	CMC-AB5PR5K-6	DM10C050K5	C: FXD DIPPED MICA 5pF ±10% 500V
C234	CMC-AB7PR5K-6	DM10C070K5	C: FXD DIPPED MICA 7pF ±10% 500V
C235	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C236	CMC-AB5PR5K-6	DM10C050K5	C: FXD DIPPED MICA 5pF ±10% 500V
C237	CTM-AR10P-1	TTA23A100	C: VAR CER 10pF
C238	CMC-AB10PR5K-6	DM10C100K5	C: FXD DIPPED MICA 10pF ±10% 500V
C239	CTM-AJ10P-1	TTA43A100	C: VAR CER 10pF
C240	CTM-AJ10P-1	TTA43A110	C: VAR CER 10pF
C241	CMC-AB10PR5K-6	DM10C100K5	C: FXD DIPPED MICA 10pF ±10% 500V
C242	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C243	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C244	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C245	CSM-AC10P50V-1	10PF50WV	C: FXD CER 10pF ±10% 50V
C246	CSM-AC8P50V-1	8PF50WV	C: FXD CER 8pF ±10% 50V
C247	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C248	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C249	CSM-AC3P50V-1	3PF50WV	C: FXD CER 3pF ±10% 50V
C250	CSM-AC3P50V-1	3PF50WV	C: FXD CER 3pF ±10% 50V
C251	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C252	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C253 thru C255	CTM-AB6P	ECV1ZW06X31	C: VAR CER 6pF
C256	CSM-AC3P50V-1	3PF50WV	C: FXD CER 3pF ±10% 50V
C257	CTM-AB10P-1	ECV1ZW10X31	C: VAR CER 10pF
C258	CSM-AC3P50V-1	3PF50WV	C: FXD CER 3pF ±10% 50V
C259	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C260	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C261	CSM-AC3P50V-1	3PF50WV	C: FXD CER 3pF ±10% 50V
C262	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10μF ±20% 35V
C263	CSM-AC1P50V-1	1PF50WV	C: FXD CER 1pF ±10% 50V
C264	CTM-AB6P-1	ECV1ZW06X31	C: VAR CER 6pF
C265	CCP-AC1P50V-4	C35NP01H010C	C: FXD CHIP 1pF ±0.25% 50V
C266	CCP-AC1P50V-4	C35NP01H010C	C: FXD CHIP 1pF ±0.25% 50V
C267			Not assigned
C268	CSM-AC1P50V-1	1PF50WV	C: FXD CER 1pF ±10% 50V
C269	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C270	CCP-ADR01U50V-1	C52AF1H103Z	C: FXD CHIP 0.01μF +80, -20% 50V
C271	CCP-ADR01U50V-1	C52AF1H103Z	C: FXD CHIP 0.01μF +80, -20% 50V
C272			Not assigned
C273	CCP-AC1P50V-4	C2012C0G1H010C	C: FXD CHIP 1pF ±0.25% 50V
C274	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C275	CCP-ADR01U50V-1	C52AF1H103Z	C: FXD CHIP 0.01μF +80, -20% 50V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C276	CCP-ADR01U50V-1	C52AF1H103Z	C: FXD CHIP 0.01μF +80, -20% 50V
C277	CCP-AC1P50V-4	C35NP01H010C	C: FXD CHIP 1pF ±0.25% 50V
C278	CCP-AC1P50V-4	C35NP01H010C	C: FXD CHIP 1pF ±0.25% 50V
C279	CMC-AB15PR5K-6	DM10C150K5	C: FXD DIPPED MICA 15pF ±10% 500V
C280	CMC-AB15PR5K-6	DM10C150K5	C: FXD DIPPED MICA 15pF ±10% 500V
C281	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C282 thru C288			Not assigned
C289	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C290	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C291	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C292	CTM-AC10P-1	ECV1ZW10X32	C: VAR CER 10pF
C293	CTM-AC10P-1	ECV1ZW10X32	C: VAR CER 10pF
C294 thru C297	CTM-AB6P-1	ECV1ZW06X31	C: VAR CER 6pF
C298 thru C301	CSM-AC3P50V-1	3PF50WV	C: FXD CER 3pF ±10% 50V
C302	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C303	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C304	CTM-AC20P-1	ECV1ZW20X32	C: VAR CER 20pF
C305	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C306	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C307	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10μF ±20% 35V
C308	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10μF ±20% 35V
C309	CMC-AB82PR3K-4	DM10D820J3	C: FXD DIPPED MICA 82pF ±5% 300V
C310	CTM-AC20P-1	ECV1ZW20X32	C: VAR CER 20pF
C311	CMC-AB82PR3K-4	DM10D820J3	C: FXD DIPPED MICA 82pF ±5% 300V
C312	CTM-AC20P-1	ECV1ZW20X32	C: VAR CER 20pF
C313	CMC-AB8PR5K-6	DM10C080K5	C: FXD DIPPED MICA 8pF ±10% 500V
C314 thru C319	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C320	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C321 thru C330	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C331	CMC-AB3PR5K-2	DM10C030D5	C: FXD DIPPED MICA 3pF ±0.5% 500V
C332	CMC-AB2PR5K-2	DM10C020D5	C: FXD DIPPED MICA 3pF ±0.5% 500V
C333	CMC-AB3PR5K-2	DM10C030D5	C: FXD DIPPED MICA 3pF ±0.5% 500V
C334	CMC-AB100PR3K-4	DM10D101J3	C: FXD DIPPED MICA 100pF ±5% 300V
C335	CMC-AB82PR3K-4	DM10D820J3	C: FXD DIPPED MICA 82pF ±5% 300V
C336	CMC-AB82PR3K-4	DM10D820J3	C: FXD DIPPED MICA 82pF ±5% 300V
C337	CMC-AB100PR3K-4	DM10D101J3	C: FXD DIPPED MICA 100pF ±5% 300V
C338 thru C344	CTM-AC20P	ECV1ZW20X32	C: VAR CER 20pF
C345	CMC-AB82PR3K-4	DM10D820J3	C: FXD DIPPED MICA 82pF ±5% 300V
C346	CMC-AB68PR3K-4	DM10D680J3	C: FXD DIPPED MICA 68pF ±5% 300V
C347	CMC-AB82PR3K-4	DM10D820J3	C: FXD DIPPED MICA 82pF ±5% 300V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C348	CMC-AB5PR5K-6	DM10C050K5	C: FXD DIPPED MICA 5pF ±10% 500V
C349	CMC-AB5PR5K-6	DM10C050K5	C: FXD DIPPED MICA 5pF ±10% 500V
C350 thru C356	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C357	CMC-AB68PR3K-4	DM10D680J3	C: FXD DIPPED MICA 68pF ±5% 300V
C358	CMC-AB68PR3K-4	DM10D680J3	C: FXD DIPPED MICA 68pF ±5% 300V
C359 thru C362	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C363			Not assigned
C364	CMC-AB27PR3K-4	DM10D270J3	C: FXD DIPPED MICA 27pF ±5% 300V
C365	CMC-AB220PR3K-4	DM10D221J3	C: FXD DIPPED MICA 220pF ±5% 300V
C366	CMC-AB82PR3K-4	DM10D820J3	C: FXD DIPPED MICA 82pF ±5% 300V
C367 thru C369	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C370	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C371	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10μF ±20% 35V
C372	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C373	CSM-ACR01U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C374	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C375	CTM-AC20P-1	ECV1ZW20X32	C: VAR CER 20pF
C376	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C377 thru C380	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C381	CMC-AB82PR3K-4	DM10D820J3	C: FXD DIPPED MICA 82pF ±5% 300V
C382	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C383	CMC-AB82PR3K-4	DM10D820J3	C: FXD DIPPED MICA 82pF ±5% 300V
C384	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C385	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C386	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C387	CMC-AB5PR5K-6	DM10C050K5	C: FXD DIPPED MICA 5pF ±10% 500V
C388	CCP-AC1P50V-4	C35NP01H010C	C: FXD CHIP 1pF ±0.25% 50V
L391 thru L393	LCL-A00062-1	LS20	L: FXD Coil
L394	MBM-14302A-1	*	L: FXD Coil
L395	MBM-14302A-1	*	L: FXD Coil
L396	LCL-A00059-1	LS17	L: FXD Coil
L397 thru L399	MBM-14302A-1	*	L: FXD Coil
L400	LCL-A00059-1	LS17	L: FXD Coil
L401	LCL-B00376-1	TPF0410-331K	L: FXD Coil
L402	LCL-A00059-1	LS17	L: FXD Coil
L403 thru L405			L: FXD Coil Pattern
L406	LCL-A00062-1	LS20	L: FXD Coil
L407	LCL-A00063-1	LS21	L: FXD Coil
L408	LCL-A00062-1	LS20	L: FXD Coil

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Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
L409	LCL-A00063-1	LS21	L: FXD Coil
L410 thru L413	MEM-14307A-1	*	L: FXD Coil
L414	LCL-A00062-1	LS20	L: FXD Coil
L415	LCL-A00062-1	LS20	L: FXD Coil
L416	LCL-A00070-1	LS28	L: FXD Coil
L417	LCL-A00070-1	LS28	L: FXD Coil
L418 thru L420	LCL-B00376-1	TPF0410-331K	L: FXD Coil
L421 thru L423	LCL-A00070-1	LS28	L: FXD Coil
L424	LCL-A00069-1	LS27	L: FXD Coil
L425	LCL-A00070-1	LS28	L: FXD Coil
L426	LCL-A00070-1	LS28	L: FXD Coil
L427	LCL-A00069-1	LS27	L: FXD Coil
L428	LCL-A00067-1	LS25	L: FXD Coil
L429	LCL-B00376-1	TPF0410-331K	L: FXD Coil
L430	LCL-C00329-1	*	L: FXD Coil
L431	LCL-B00363-1	TPF0410-1R5K	L: FXD Coil
L432	LCL-C00329-1	*	L: FXD Coil
L433	LCL-C00329-1	*	L: FXD Coil
X441	DXD-000159-1	*	Crystal
X442	DNF-000140-1	*	Crystal
T445	LCL-E00389-1	*	Transformer
T446	LCL-E00389-1	*	Transformer
T447	LCL-C00124-1	*	Transformer
T448	LCL-C00124-1	*	Transformer
T449	LCL-E00388-1	*	Transformer

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
FL1 thru FL3	DNF-000601-1	ZFN5101-01R	Filter
FL4 thru FL11	DNF-000471-1	*	Filter
FL12	DNF-000601-1	ZFN5101-01R	Filter
HB21	SHB-000553-1	*	2.05GHz TUNED Amplifier and Band Pass Filter
HB22	DHB-000639-1	*	2.2GHz Low Pass Filter
J26		*	2.2GHz Lom Pass Filter
thru J30	JCF-AA001JX20-2	50-645-4526-89	Connector
J31			Not assigned
J32			Not assigned
J33	JCF-AA001JX20-2	50-645-4526-89	Connector
J34			Not assigned
thru J40	JCF-AC001JX02-2	UM-QR	Connector
J41 thru J49			Not assigned
J50	DCB-QR1040X01-1	HIF3-10P-CO35HENC-NL	Connector
J51	JCS-AD005PX05-1	PCN6B-5P-2.54E	Connector

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1	SIA-301A-2	UPC157A	IC: Operational Amplifier
Q11 thru Q13	STN-2SC2585-1	2SC2585	Transistor SI NPN
D21	SDS-1SS97-1	1SS97	Diode SI
D22	SDS-1SS97-1	1SS97	Diode SI
D23	SDS-HP2520-1	5082-2520	Diode SI
D24	SDS-1SS97-1	1SS97	Diode SI
R31	RCB-AH1R5K-1	RD25S1.5KΩJ	R: FXD CAR 1.5kΩ ±5% 1/4W
R32	RCB-AH6R8K-1	RD25S6.8KΩF	R: FXD CAR 6.8kΩ ±5% 1/4W
R33	RCB-AH6R8K-1	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R34	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R35	RCB-AH120-1	RD25S120ΩJ	R: FXD CAR 120Ω ±5% 1/4W
R36	RCB-AH180-1	RD25S180ΩJ	R: FXD CAR 180Ω ±5% 1/4W
R37	RCB-AH1R5K-1	RD25S1.5KΩJ	R: FXD CAR 1.5kΩ ±5% 1/4W
R38	RCB-AH6R8K-1	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R39	RCB-AH6R8K-1	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R40	RCB-AH330-1	RD25S330ΩJ	R: FXD CAR 330Ω ±5% 1/4W
R41	RCB-AH120-1	RD25S120ΩJ	R: FXD CAR 120Ω ±5% 1/4W
R42	RCB-AH180-1	RD25S180ΩJ	R: FXD CAR 180Ω ±5% 1/4W
R43	RCB-AH1R5K-1	RD25S1.5KΩJ	R: FXD CAR 1.5kΩ ±5% 1/4W
R44	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R45	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R46	RCB-AH330-1	RD25S330ΩJ	R: FXD CAR 330Ω ±5% 1/4W
R47	RCB-AH120-1	RD25S120ΩJ	R: FXD CAR 120Ω ±5% 1/4W
R48	RCB-AH270-1	RD25S270ΩJ	R: FXD CAR 270Ω ±5% 1/4W
R49	RCP-AB22-5	MCR18-22ΩK	R: FXD CHIP 22Ω
R50	RCP-AB51-3	MCR18-51ΩJ	R: FXD CHIP 51Ω
R51	RCP-AB120-3	MCR18-120ΩJ	R: FXD CHIP 120Ω
R52	RCP-AB51-3	MCR18-51ΩJ	R: FXD CHIP 51Ω
R53	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R54	RCB-AH22K-1	RD25S22KΩJ	R: FXD CAR 22kΩ ±5% 1/4W
R55	RVR-BD2K-1	X6S2KΩ	R: VAR WW 2kΩ
R56	RCB-AH39K-1	RD25S39KΩJ	R: FXD CAR 39kΩ ±5% 1/4W
R57	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R58	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R59	DHB-000329-1	*	R: 3dB PAD
R60	DHB-000333-1	*	R: 6dB PAD
R61	RCB-AH39K-1	RD25S39KΩJ	R: FXD CAR 39kΩ ±5% 1/4W
R62	DHB-000332-1	*	R: 3dB PAD
C71 thru C76			Not assigned
C77	CCP-AGR47U50V-1	C76AF1H474Z	C: FXD CHIP 47μF +80, -20%, 50V
C78			Not assigned
C79	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C80	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C81	CCP-AGR47U50V-1	C5650Y5V1H474Z	C: FXD CHIP 0.47μF +80, -20% 50V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C82	CCP-AGR47U50V-1	C76AF1H474Z	C: FXD CHIP 0.47μF +80, -20% 50V
C83	CCP-ADR1U50V-1	C52AF1H104Z	C: FXD CHIP 0.1μF +80, -20% 50V
C84	CCP-AGR47U50V-1	C76AF1H474Z	C: FXD CHIP 0.47μF +80, -20% 50V
C85			Not assigned
C86	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C87	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C88	CCP-AGR47U50V-1	C76AF1H474Z	C: FXD CHIP 0.47μF +80, -20% 50V
C89	CCP-AGR47U50V-1	C5650Y5V1H474Z	C: FXD CHIP 0.47μF +80, -20% 50V
C90	CCP-ADR1U50V-1	C52AF1H104Z	C: FXD CHIP 0.1μF +80, -20% 50V
C91	CCP-AGR47U50V-1	C76AF1H474Z	C: FXD CHIP 0.47μF +80, -20% 50V
C92			Not assigned
C93	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C94	CCP-AGR47U50V-1	C76AF1H474Z	C: FXD CHIP 0.47μF +80, -20% 50V
C95			Not assigned
C96	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C97	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C98	CCP-AGR47U50V-1	C76AF1H474Z	C: FXD CHIP 0.47μF +80, -20% 50V
C99	CCP-AGR47U50V-1	C5650Y5V1H474Z	C: FXD CHIP 0.47μF +80, -20% 50V
C100	CCP-ADR1U50-1	C52AF1H104Z	C: FXD CHIP 0.1μF +80, -20% 50V
C101	CCP-AGR47U50-1	C76AF1H474Z	C: FXD CHIP 0.47μF +80, -20% 50V
C102			Not assigned
C103	CCP-ADR1U50V-1	C52AF1H104Z	C: FXD CHIP 0.1μF +80, -20% 50V
C104	CCP-AC1P50V-4	C35NP01H010C	C: FXD CHIP 1pF ±0.25% 50V
C105	CTM-AQ1R2P-1	7263	C: VAR CER
C106	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C107	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C108	CSM-AC33P50V-1	33PF50WV	C: FXD CER 33pF ±10% 50V
C109	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C110	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C111	CCP-AGR47U50V-1	C76AF1H474Z	C: FXD CER 0.47μF +80, -20% 50V
C112			Not assigned
C113			Not assigned
C114	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10μF ±20% 35V
C115	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10μF ±20% 35V
C116 thru C118			Not assigned
C119	CSM-AC1P50V-1	1PF50WV	C: FXD CER 1pF ±10% 50V
C120	CTM-AB6P-1	ECV1ZW06X31	C: VAR CER 6pF
L121	LCL-A00027-1	*	L: FXD Coil
L122			L: FXD Coil
L123	LCL-A00027-1	*	L: FXD Coil
L124			L: FXD Coil
L125	LCL-B00376-1	TPF0410-331K	L: FXD Coil
L126	LCL-B00376-1	TPF0410-331K	L: FXD Coil
L127	LCL-A00027-1	*	L: FXD Coil
L128			L: FXD Coil
C131	CSM-AC1P50V-1	1PF50WV	C: FXD CER 1pF ±10% 50V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C132	CCP-ADR1U50V-1	C52AF1H104Z	C: FXD CHIP 0.1μF +80, -20% 50V

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Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
Q1	STN-2SC1730-1	2SC1730	Transistor SI NPN
Q2 thru Q6	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q7	SFN-2SK141-2	ITS30088B	FET Junction N-Channel
Q8 thru Q10	STN-2SC1254-1	2SC1254	Transistor SI NPN
D21	SDS-1S1765-1	1S1765	Diode SI
D22 thru D30	SDS-1S2222-1	1S2222	Diode SI
D31 thru D38	SDS-1SS97-1	1SS97	Diode SI
D39 thru D41			Not assigned
D42 thru D44	SDS-1S2222-1	1S2222	Diode SI
R51	RCB-AH100K-1	RD25S100KΩJ	R: FXD CAR 100kΩ ±5% 1/4W
R52	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R53	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R54	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R55	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R56	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R57	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R58	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R59	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R60	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R61	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R62	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R63	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R64	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R65	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R66	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R67	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R68	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R69	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R70	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R71	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R72	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R73	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R74	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R75	RCB-AH10-1	RD25S10ΩJ	R: FXD CAR 10Ω ±5% 1/4W
R76	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R77	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R78	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R79	RCB-AH10-1	RD25S10ΩJ	R: FXD CAR 10Ω ±5% 1/4W
R80	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R81	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R82	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R83	RCB-AH10-1	RD25S10ΩJ	R: FXD CAR 10Ω ±5% 1/4W
R84	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R85	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R86	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R87	RCB-AH68-1	RD25S68ΩJ	R: FXD CAR 68Ω ±5% 1/4W
R88	RCB-AH150-1	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R89	RCB-AH68-1	RD25S68ΩJ	R: FXD CAR 68Ω ±5% 1/4W
R90	RCB-AH6R8K-1	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R91	RCB-AH6R8K-1	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R92	RCB-AH820-1	RD25S820ΩJ	R: FXD CAR 820Ω ±5% 1/4W
R93	RCB-AH68-1	RD25S68ΩJ	R: FXD CAR 68Ω ±5% 1/4W
R94	RCB-AH150-1	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R95	RCB-AH68-1	RD25S68ΩJ	R: FXD CAR 68Ω ±5% 1/4W
R96	RCB-AH6R8K-1	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R97	RCB-AH6R8K-1	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R98	RCB-AH820-1	RD25S820ΩJ	R: FXD CAR 820Ω ±5% 1/4W
R99	RCB-AH6R8K-1	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R100	RCB-AH6R8K-1	RD25S6.8KΩJ	R: FXD CAR 6.8kΩ ±5% 1/4W
R101	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R102			Not assigned
R103			Not assigned
R104			Not assigned
R105	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R106	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R107	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R108	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R109	RCB-AH51-1	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R110	RCB-AH51-1	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
C121	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C122	CTM-AC20P-1	ECV1ZW20X32	C: VAR WW 20pF
C123	CMC-AB220PR3K-4	DM10D221J3	C: FXD DIPPED MICA 220pF ±5% 300V
C124	CMC-AC560PR3K-1	DM15C561J3	C: FXD DIPPED MICA 560pF ±5% 300V
C125	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF 80, -20% 50V
C126	CMC-AB68PR3K-4	DM10D680J3	C: FXD DIPPED MICA 68pF ±5% 300V
C127 thru C143	CSACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF 80, -20% 50V
C144	CMC-AC1200PR3K-2	DM15D122J3	C: FXD DIPPED MICA 1200pF ±5% 300V
C145	CMC-AD1800PR5K-2	DM19D182J5	C: FXD DIPPED MICA 1800pF ±5% 500V
C146	CMC-AC1200PR3K-2	DM15D122J3	C: FXD DIPPED MICA 1200pF ±5% 300V
C147 thru C149	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C150			Not assigned
C151	CMC-AB10PR5K-6	DM10C100K5	C: FXD DIPPED MICA 10pF ±10% 500V
C152	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C153	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C154	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C155	CMC-AB10PR5K-6	DM10C100K5	C: FXD DIPPED MICA 10pF ±10% 500V
C156	CTM-AC20P-1	ECV1ZW20x32	C: VAR WW 20pF
C157	CMC-AB82PR3K-4	DM10D820J3	C: FXD DIPPED MICA 82pF ±5% 300V
C158	CMC-AB7PR5K-3	DM10D070K5	C: FXD DIPPED MICA 7pF ±10% 500V
C159	CTM-AC20P-1	ECV1ZW20X32	C: VAR CER 20pF
C160	CMC-AB82PR3K-4	DM10D820J3	C: FXD DIPPED MICA 82pF ±5% 300V
C161	CMC-AB7PR5K-3	DM10D070K5	C: FXD DIPPED MICA 7pF ±10% 500V
C162	CTM-AC20P-1	ECV1ZW20X32	C: VAR CER 20pF
C163	CMC-AB82PR3K-4	DM10D820J3	C: FXD DIPPED MICA 82pF ±5% 300V
C164	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C165			Not assigned
C166	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C167	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C168	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C169	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C170	CSM-AC6P50V-1	6PF50WV	C: FXD CER 6pF ±10% 50V
C171	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C172	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C173	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C174	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C175	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C176	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C177	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C178	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C179	CTM-AB10P-1	ECV1ZW10X31	C: VAR WW 10pF
C180 thru C182	CSM-AC3P50V-1	3PF50WV	C: FXD CER 3pF ±10% 50V
C183 thru C185	CTM-AB6P-1	ECV1ZW06X31	C: VAR CER 6pF
C186 thru C188			Not assigned
C189 thru C190	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C191	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C192	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C193	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10μF ±20% 35V
C194	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10μF ±20% 35V
C195	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C196			Not assigned
C197	CMC-AB10PR5K-6	DM10C100K5	C: FXD DIPPED MICA 10pF ±10% 500V
L201	LCL-B00364-1	TPF0410-2R2K	L: FXD Coil
L202	LCL-B00364-1	TPF0410-2R2K	L: FXD Coil
L203	LCL-B00363-1	TPF0410-1R5K	L: FXD Coil
L204	LCL-B00376-1	TPF0410-331K	L: FXD Coil
L205	LCL-B00363-1	TPF0410-1R5K	L: FXD Coil
L206	LCL-B00376-1	TPF0410-331K	L: FXD Coil

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
L207 thru L209	LCL-A00070-1	LS28	L: FXD Coil
L210	LCL-A000-61-1	LS19	L: FXD Coil
L211	LCL-A00063-1	LS21	L: FXD Coil
L212	LCL-B00376-1	TPF0410-331K	L: FXD Coil
L213	LCL-A00061-1	LS19	L: FXD Coil
L214	LCL-A00063-1	LS21	L: FXD Coil
L215	LCL-A00061-1	LS19	L: FXD Coil
L216	LCL-B00376-1	TPF0410-331K	L: FXD Coil
L217	LCL-A00063-1	LS21	L: FXD Coil
L218 thru L220	MEM-14307A-1	*	L: FXD Coil
L221	LCL-B00376-1	TPF0410-331K	L: FXD Coil
T231	LCL-C00117-1	*	Transformer
T232	LCL-C00117-1	*	Transformer
T233	LTP-000270-1	*	Transformer
T234	LTP-000270-1	*	Transformer
X241	DXD-000143-1	*	Crystal
	JTT-AB001EX04-1	A-105	Hermetic Seal

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
Q1	STN-2SC2150-1	2SC2150	Transistor SI NPN
Q2	STN-2SC2150-1	2SC2150	Transistor SI NPN
D5	SDS-1SS97-1	1SS97	Diode SI
D6	SDS-1SS97-1	1SS97	Diode SI
R11	RCB-AH1R5K-1	RD25S1.5KΩJ	R: FXD CAR 1.5kΩ ±5% 1/4W
R12	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R13	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R14	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R15	RCB-AH1R5K-1	RD25S1.5KΩJ	R: FXD CAR 1.5kΩ ±5% 1/4W
R16	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R17	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R18	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R19	DHB-000333-1	*	R: 6dB PAD
R20	DHB-000333-1	*	R: 6dB PAD
C31	CCP-ADR01U50V-1	C52AF1H103Z	C: FXD CHIP 0.01uF +80, -20% 50V
C32			Not assigned
C33	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C34	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C35 thru C37	CCP-ADR01U50V-1	C52AF1H103Z	C: FXD CHIP 0.01uF +80, -20% 50V
C38			Not assigned
C39	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C40	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C41	CCP-ADR01U50V-1	C52AF1H103Z	C: FXD CHIP 0.01uF +80, -20% 50V
C42	CCP-ADR01U50V-1	C52AF1H103Z	C: FXD CHIP 0.01uF +80, -20% 50V
C43	CMC-AB15PR5K-6	DM10C150K5	C: FXD DIPPED MICA 15pF ±10% 500V
C44	CMC-AB15PR5K-6	DM10C150K5	C: FXD DIPPED MICA 15pF ±10% 500V
C45 thru C48	CCP-AC1P50V-4	C35NP01H010C	C: FXD CHIP 1pF ±0.5% 50V
C49	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C50	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10uF ±20% 35V
L61			L: FXD Coil
L62			L: FXD Coil
L63	LCL-A00062-1	LS20	L: FXD Coil
L64	LCL-A00063-1	LS21	L: FXD Coil
L65	LCL-A00062-1	LS20	L: FXD Coil
L66	LCL-B00376-1	TPF040-331K	L: FXD Coil

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
FL1 thru FL25	DNF-00060l-1	ZFN5101-01R	Filter
J81 thru J83	JCF-AC001JX02-2	UM-QR	Connector
J84			Not assigned
J85			Not assigned
J86 thru J89	JCF-AD005PX05-1	PCN6B-5P-2.5E	Connector
J90	JCF-AC001JX03-2	UM-QR-1	Connector
J91 thru J99			Not assigned
J100	JCS-AD005PX05-1	PCN6B-5P-2.5E	Connector
J101	DCB-QR1041X01-1	HIF3-16P-CO30HENC	Connector

TR4172
153MHz MIXER
BLC-010099

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
Q1	STN-2SC1275-1	2SC1275	Transistor SI NPN
Q2 thru Q8	STN-2SC2026-1	2SC2026	Transistor SI NPN
D11			Not assigned
D12	SDS-1S2222-1	1S2222	Diode SI
D13	SDS-1S2222-1	1S2222	Diode SI
R21	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R22	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R23	RCB-AG220	RD12S220ΩJ	R: FXD CAR 220Ω ±5% 1/8W
R24	RCB-AH22-1	RD25S22ΩJ	R: FXD CAR 22Ω ±5% 1/4W
R25	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R26	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R27	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R28	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R29	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R30	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R31	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R32	RCB-AH120-1	RD25S120ΩJ	R: FXD CAR 120Ω ±5% 1/4W
R33	RCB-AH75-1	RD25S75ΩJ	R: FXD CAR 75Ω ±5% 1/4W
R34	RCB-AH8R2K-1	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R35	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R36	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R37	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R38	RCB-AH680-1	RD25S680ΩJ	R: FXD CAR 680Ω ±5% 1/4W
R39	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R40	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R41	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R42	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R43	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R44 thru R46	RCB-AH22-1	RD25S22ΩJ	R: FXD CAR 22Ω ±5% 1/4W
R47	RCB-AH330-1	RD25S330ΩJ	R: FXD CAR 330Ω ±5% 1/4W
R48			Not assigned
R49 thru R51	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R52	RCB-AG33	RD12S33ΩJ	R: FXD CAR 33Ω ±5% 1/8W
R53	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R54	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R55	RCB-AG220	RD12S220ΩJ	R: FXD CAR 220Ω ±5% 1/8W
R56	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R57	RCB-AH22-1	RD25S22ΩJ	R: FXD CAR 22Ω ±5% 1/4W
R58	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R59	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R60	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R61	RCB-AH680-1	RD25S680ΩJ	R: FXD CAR 680Ω ±5% 1/4W
R62	RCB-AH22-1	RD25S22ΩJ	R: FXD CAR 22Ω ±5% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R63	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R64	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R65	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R66	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R67	RCB-AH82-1	RD25S82ΩJ	R: FXD CAR 82Ω ±5% 1/4W
R68	RCB-AH150-1	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R69	RCB-AH39-1	RD25S39ΩJ	R: FXD CAR 39Ω ±5% 1/4W
R70	RCB-AH150-1	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R71	RCB-AG51-1	RD12S51ΩJ	R: FXD CAR 51Ω ±5% 1/8W
R72	RCB-AH51-1	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
C81	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C82	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C83	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C84	CTM-AC10P-1	ECV1ZW10X32	C: VAR CER 10pF
C85	CMC-AB3PR5K-2	DM10C030D5	C: FXD DIPPED MICA 3pF ±0.5% 500V
C86	CMC-AB5PR5K-2	DM10C050D5	C: FXD DIPPED MICA 5pF ±0.5% 500V
C87	CMC-AB7PR5K-6	DM10C070K5	C: FXD DIPPED MICA 7pF ±10% 500V
C88	CMC-AB22PR5K-4	DM10D220J5	C: FXD DIPPED MICA 22pF ±5% 500V
C89	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C90	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C91	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C92	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C93	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C94	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C95	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C96	CMC-AB22PR5K-4	DM10D220J5	C: FXD DIPPED MICA 22pF ±5% 500V
C97	CSM-AC22P50V-1	22PF50WV	C: FXD CER 22pF ±10% 50V
C98	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C99	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C100	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C101	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C102	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C103	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C104	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C105	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C106	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C107	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C108	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C109	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C110	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C111	CMC-AB20PR5K-6	DM10C200K5	C: FXD DIPPED MICA 20pF ±10% 500V
C112	CTM-AC6P-1	ECV1ZW06X032	C: VAR CER 6pF
C113	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF
C114	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C115	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10μF 25V
C116	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10μF 25V
C117	CMC-AB220PR3K-4	DM10D221J3	C: FXD DIPPED MICA 220pF ±5% 300V
C118	CMC-AB220PR3K-4	DM10D221J3	C: FXD DIPPED MICA 220pF ±5% 300V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C119	CSM-AC15P50V-1	15PF50WV	C: FXD CER 15pF ±10% 50V
L131	LCL-A00063-1	LS21	L: FXD Coil
L132	LCL-A00062-1	LS20	L: FXD Coil
L133	LCL-A00061-1	LS19	L: FXD Coil
L134	LCL-A00062-1	LS20	L: FXD Coil
L135	LCL-A00060-1	LS18	L: FXD Coil
L136	LCL-C00012-1	CSL0609-471K	L: FXD Coil
L137	LCL-B00492-1	TPF0410-R39K	L: FXD Coil
L138	LCL-A00061-1	LS19	L: FXD Coil
L139	LCL-A00061-1	LS19	L: FXD Coil
X146	DXD-000147-1	*	Crystal
MIX151	DEE-000736-1	*	Mixer
T156	LCL-E00388-1	*	Transformer
J161	JCF-AC001JX04-1	UM-R-PC	Connector
F166	DNF-000602-1	*	Filter
F167	DNF-000602-1	*	Filter

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TR4172
39MHz MIXER
BLC-010100

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
Q1	STN-2SC1730-1	2SC1730	Transistor SI NPN
Q2	STN-2SC2026-1	2SC2026	Transistor SI NPN
Q3	STN-2SC2026-1	2SC2026	Transistor SI NPN
R21	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R22	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R23	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R24	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R25	RCB-AH12K-1	RD25S12KΩJ	R: FXD CAR 12kΩ ±5% 1/4W
R26	RCB-AH12K-1	RD25S12KΩJ	R: FXD CAR 12kΩ ±5% 1/4W
R27	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R28	RCB-AH150-1	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R29	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R30	RCB-AH12K-1	RD25S12KΩJ	R: FXD CAR 12kΩ ±5% 1/4W
R31	RCB-AH12K-1	RD25S12KΩJ	R: FXD CAR 12kΩ ±5% 1/4W
R32	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R33	RCB-AH22-1	RD25S22ΩJ	R: FXD CAR 22Ω ±5% 1/4W
R34	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R35	RCB-AH270-1	RD25S270ΩJ	R: FXD CAR 270Ω ±5% 1/4W
R36	RCB-AH15-1	RD25S15ΩJ	R: FXD CAR 15Ω ±5% 1/4W
R37	RCB-AH270-1	RD25S270ΩJ	R: FXD CAR 270Ω ±5% 1/4W
C41	CMC-AB15PR5K-6	DMC10C150K5	C: FXD DIPPED MICA 15pF ±10% 500V
C42	CMC-AB12PR5K-6	DMC10C120K5	C: FXD DIPPED MICA 12pF ±10% 500V
C43	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047 μF +80, -20% 50V
C44	CMC-AB18PR5K-6	DM10C180K5	C: FXD DIPPED MICA 18pF ±10% 500V
C45	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01 μF +80, -20% 50V
C46	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047 μF +80, -20% 50V
C47	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047 μF +80, -20% 50V
C48	CTM-AA10P-1	ECV1ZW10X53N	C: VAR CER 10pF
C49	CMC-AB62PR3K-4	DM10D620J3	C: FXD DIPPED MICA 62pF ±5% 300V
C50	CMC-AB62PR3K-4	DM10D620J3	C: FXD DIPPED MICA 62pF ±5% 300V
C51	CTM-AA10P-1	ECV1ZW10X53N	C: VAR CER 10pF
C52	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01 μF +80, -20% 50V
C53	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047 μF +80, -20% 50V
C54	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047 μF +80, -20% 50V
C55	CTM-AA10P-1	ECV1Z10X53N	C: VAR CER 10pF
C56	CMC-AB62PR3K-4	DM10D620J3	C: FXD DIPPED MICA 62pF ±5% 300V
C57	CMC-AB62PR3K-4	DM10D620J3	C: FXD DIPPED MICA 62pF ±5% 300V
C58	CTM-AA10P-1	ECV1ZW10X53N	C: VAR CER 10pF
C59	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10 μF 25V
C60	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10 μF 25V
C61	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047 μF +80, -20% 50V
L71	LCL-C00111-1	*	L: FXD Coil
L72 thru L75	LCL-A00371-1	TPF0410-330K	L: FXD Coil
L76	LCL-C00012-1	CSL0609-471K	L: FXD Coil
X81	DXD-000435-1	*	Crystal

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
T85	ESM-000129-1	Q5BRH3.4X3X1	Transformer
T86	ESM-000129-1	Q5BRH3.4X3X1	Transformer
T87	ESM-000129-1	Q5BRH3.4X3X1	Transformer
J91	JCF-AC001JX04-1	UM-R-PC	Connector
J92	JCF-AC001JX04-1	UM-R-PC	Connector
MIX95	DEE-000736-1	*	Mixer

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Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1	SIC-11C91-1	11C91DC	IC: 650MHz Divided-by 5/6 Prescaler
IC2	SIT-74874-9	SN74S74N	IC: Dual D-Type Edge Triggered Flip-Flop
IC3	SIA-TL072-1	TL072CP	IC: Low noise JFET Input Operational Amplifier
IC4	SIA-TL072-1	TL072CP	IC: Low noise JFET Input Operational Amplifier
Q11	SFN-U309-1	U-309	FET Junction N-Channel
Q12	SFN-U309-1	U-309	FET Junction N-Channel
Q13	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q14 thru Q16	STN-2SC2026-1	2SC2026	Transistor SI NPN
D21	SDS-DKV6522B-1	DKV-6522B	Hyperabrupt Tuning Varactor Diode
D22 thru D24	SDS-1S2222-1	1S2222	Diode SI
D25	SDS-1S2191-1	1S2191	Zener Diode
D26	SDS-1S953-1	1S953	Diode SI
D27			Not assigned
D28	SDS-1SS101-1	1SS101	Diode SI
D29	SDS-1S953-1	1S953	Diode SI
D30	SDS-1S953-1	1S953	Diode SI
R41	RCB-AH390-1	RD25S390ΩJ	R: FXD CAR 390Ω ±5% 1/4W
R42	RCB-AH8R2K-1	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R43			Not assigned
R44	RCB-AH270-1	RD25S270ΩJ	R: FXD CAR 270Ω ±5% 1/4W
R45	RCB-AH51-1	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R46	RCB-AH150-1	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R47	RCB-AH820K-1	RD25S820KΩJ	R: FXD CAR 820kΩ ±5% 1/4W
R48	RVR-BE20K-1	X6T20KΩ	R: VAR WW 20kΩ
R49	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R50	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R51	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R52	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R53	RCB-AH22-1	RD25S22ΩJ	R: FXD CAR 22Ω ±5% 1/4W
R54	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R55	RCB-AH22-1	RD25S22ΩJ	R: FXD CAR 22Ω ±5% 1/4W
R56	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R57	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R58	RCB-AH22-1	RD25S22ΩJ	R: FXD CAR 22Ω ±5% 1/4W
R59	RCB-AH22-1	RD25S22ΩJ	R: FXD CAR 22Ω ±5% 1/4W
R60	RCB-AH27-1	RD25S27ΩJ	R: FXD CAR 27Ω ±5% 1/4W
R61	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R62	RCB-AH2R7K-1	RD25S2.7KΩJ	R: FXD CAR 2.7kΩ ±5% 1/4W
R63	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R64	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R65	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R66	RCB-3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R67	RCB-2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R68	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R69	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R70	RCB-AH330-1	RD25S330ΩJ	R: FXD CAR 330Ω ±5% 1/4W
R71	RCB-AH10-1	RD25S10ΩJ	R: FXD CAR 10Ω ±5% 1/4W
R72	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R73	RCB-AH8R2K-1	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R74	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R75	RCB-AH22K-1	RD25S22KΩJ	R: FXD CAR 22kΩ ±5% 1/4W
R76	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R77	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R78	RCB-AH33K-1	RD25S33KΩJ	R: FXD CAR 33kΩ ±5% 1/4W
R79	RCB-AH56K-1	RD25S56KΩJ	R: FXD CAR 56kΩ ±5% 1/4W
R80	RVR-BE20K-1	X6T20KΩ	R: VAR WW 20kΩ
R81	RCB-AH8R2K-1	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R82	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R83	RCB-AH12K-1	RD25S12KΩJ	R: FXD CAR 12kΩ ±5% 1/4W
R84	RCB-AH220K-1	RD25S220KΩJ	R: FXD CAR 220kΩ ±5% 1/4W
R85			Not assigned
R86			Not assigned
R87	RCB-AH18K-1	RD25S18KΩJ	R: FXD CAR 18kΩ ±5% 1/4W
R88	RVR-CB100K-1	RJ6P100kΩ	R: VAR CERMET 100kΩ
R89	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R90	RCB-AH330-1	RD25S330ΩJ	R: FXD CAR 330Ω ±5% 1/4W
R91	RCB-AH330-1	RD25S330ΩJ	R: FXD CAR 330Ω ±5% 1/4W
R92	RVR-BE2K-1	X6T2KΩ	R: VAR WW 2kΩ
R93	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R94	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R95	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R96	RMF-AR22KFK-1	SN14K2E22KΩF	R: FXD Metal FLM 22kΩ ±1% 1/4W
R97	RCB-AH12K-1	RD25S12KΩJ	R: FXD CAR 12kΩ ±5% 1/4W
R98	RCB-AH220K-1	RD25S220KΩJ	R: FXD CAR 220kΩ ±5% 1/4W
R99	RVR-BE2K-1	X6T2KΩ	R: VAR WW 2kΩ
C101	CTM-AC10P-1	ECV1ZW10X32	C: VAR CER 10pF
C102	CMC-AB3PR5K-2	DM10C030D5	C: FXD DIPPED MICA 3pF ±0.5% 500V
C103	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C104	CCP-ADR1U50V-1	C52AF1H104Z	C: FXD CHIP 0.1μF +80, -20% 50V
C105	CCP-ADR1U50V-1	C52AF1H104Z	C: FXD CHIP 0.1μF +80, -20% 50V
C106	CTA-AB10U25V-1	221M2502-106M	C: FXD ELECT TANTAL 10μF ±20% 25V
C107	CMC-AB3PR5K-1	DM10C030D5	C: FXD DIPPED MICA 3pF ±0.5% 500V
C108			Not assigned
C109	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C110	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C111			Not assigned
C112 thru C114	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C115	CSM-AC2200P50V-1	0.00220F50WV	C: FXD CER 0.0022μF +80, -20% 50V
C116	CSM-AC10P50V-1	10PF50WV	C: FXD CER 10pF ±10% 50V
C117	CSM-AC8P50V-1	8PF50WV	C: FXD CER 8pF ±10% 50V
C118	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C119	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C120	CSM-AC2200P50V-1	0.0022UF50WV	C: FXD CER 0.0022uF +80, -20% 50V
C121 thru C129	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C130	CMC-AB120PR3K-4	DM10D121J3	C: FXD DIPPED MICA 120pF ±5% 300V
C131 thru C133	CMC-AB220PR3K-4	DM10D221J3	C: FXD DIPPED MICA 220pF ±5% 300V
C134	CMC-AB120PR3K-4	DM10D121J3	C: FXD DIPPED MICA 120pF ±5% 300V
C135	CTA-AB10U25V-1	221M2502-106M	C: FXD ELECT TANTAL 10uF ±20% 25V
C136	CTA-AB10U25V-1	221M2502-106M	C: FXD ELECT TANTAL 10uF ±20% 25V
C137 thru C141	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C142	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10uF ±20% 16V
C143	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10uF ±20% 16V
C144 thru C147	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10uF 25V
C148	CSM-AC1P50V-1	1PF50WV	C: FXD CER 1pF ±10% 50V
C149	CMC-AB82PR3K-4	DM10D820J3	C: FXD DIPPED MICA 82pF ±5% 300V
C150	CMC-AB3PR5K-2	DM10C030D5	C: FXD DIPPED MICA 3pF ±0.5% 500V
C151	CSM-AC150P50V-1	150PF50WV	C: FXD CER 150pF ±10% 50V
C152	CSM-AC6800P50V-1	0.0068UF50WV	C: FXD CER 0.0068uF +80, -20% 50V
C153	CSM-AC2200P50V-1	0.0022UF50WV	C: FXD CER 0.0022uF +80, -20% 50V
C154	CSM-AC3300P50V-1	0.0033UF50WV	C: FXD CER 0.0033uF +80, -20% 50V
C155	CMC-AB300PR3K-4	DM10D301J3	C: FXD DIPPED MICA 300pF ±5% 300V
C156	CMC-AB330PR3K-4	DM10D331J3	C: FXD DIPPED MICA 330pF ±5% 300V
L161 thru L163	LCL-B00371-1	TPF0410-330K	L: FXD Coil
L164	LCL-B00162-1	TP0410-2R2K	L: FXD Coil
L165	LCL-B00312-1	TP0410-R56K	L: FXD Coil
L166	LCL-B00492-1	TPF0410-R39K	L: FXD Coil
L167	LCL-B00360-1	TPF0410-R47K	L: FXD Coil
L168	LCL-B00360-1	TPF0410-R47K	L: FXD Coil
L169	LCL-B00492-1	TPF0410-R39K	L: FXD Coil
L170	LCL-T00084-1	*	L: FXD Coil
L171	LCL-C00012-1	CSL0609-471K	L: FXD Coil
L172	LCL-C00012-1	CSL0609-471K	L: FXD Coil
L173	DCB-QQ0042X01-1	MCT219(0.2M)	L: Coaxial Cable
L174	DCB-QQ0042X01-1	MCT219(0.2M)	L: Coaxial Cable
L175			Not assigned
L176	LCL-B00141-1	TPF0410-471K	L: FXD Coil
L177	LCC-B00159-1	TP0410-102J	L: FXD Coil
J181	JCF-AC001JX04-1	UM-R-PC	Coaxial Connector
J182	JCF-AC001JX04-1	UM-R-PC	Coaxial Connector

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1	SIC-11C91-1	11C91DC	IC: 650MHz Divided-by 5/6 Prescaler
IC2	SIC-551-1	UPB551C	IC: Ultra High Speed Prescaler
IC3	SIA-TL072-1	TL072CP	IC: Low Noise JFET Input Operational Amplifier
IC4	SIA-TL072-1	TL072CP	IC: Low Noise JFET Input Operational Amplifier
Q11	SFN-U309-1	U-309	FET Junction N-Channel
Q12	SFN-U309-1	U-309	FET Junction N-Channel
Q13	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q14 thru Q16	STN-2SC2026-1	2SC2026	Transistor SI NPN
Q17	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q18	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
D31	SDS-DKV6522B-1	DKV-6522B	Hyperabrupt Tuning Varactor Diode
D32 thru D34	SDS-1S2222-1	1S2222	Diode SI
D35	SDZ-1A2191-1	1S2191	Diode SI
D36	SDS-1S953-1	1S953	Diode SI
D37			Not assigned
D38	SDS-1SS101-1	1SS101	Diode SI
D39	SDS-1S953-1	1S953	Diode SI
D40	SDS-1S953-1	1S953	Diode SI
R51	RCB-AH390-1	RD25S390ΩJ	R: FXD CAR 390Ω ±5% 1/4W
R52	RCB-AH8R2K-1	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R53			Not assigned
R54	RCB-AH270-1	RD25S270ΩJ	R: FXD CAR 270Ω ±5% 1/4W
R55	RCB-AH51-1	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R56	RCB-AH150-1	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R57	RCB-AH820K-1	RD25S820KΩJ	R: FXD CAR 820kΩ ±5% 1/4W
R58	RVR-BE20K-1	X6T20KΩ	R: VAR WW 20kΩ
R59	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R60	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R61	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R62	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R63	RCB-AH22-1	RD25S22ΩJ	R: FXD CAR 22Ω ±5% 1/4W
R64	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R65	RCB-AH22-1	RD25S22ΩJ	R: FXD CAR 22Ω ±5% 1/4W
R66	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R67	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R68	RCB-AH22-1	RD25S22ΩJ	R: FXD CAR 22Ω ±5% 1/4W
R69	RCB-AH22-1	RD25S22ΩJ	R: FXD CAR 22Ω ±5% 1/4W
R70	RCB-AH27-1	RD25S27ΩJ	R: FXD CAR 27Ω ±5% 1/4W
R71	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R72	RCB-AH2R7K-1	RD25S2.7KΩJ	R: FXD CAR 2.7kΩ ±5% 1/4W
R73	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R74	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R75	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R76	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W

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Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R77	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R78	RCB-AH150-1	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R79	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R80	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R81	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R82	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R83	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R84	RCB-AH8R2K-1	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R85	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R86	RCB-AH22K-1	RD25S22KΩJ	R: FXD CAR 22kΩ ±5% 1/4W
R87	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R88	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R89	RCB-AH39K-1	RD25S39KΩJ	R: FXD CAR 39kΩ ±5% 1/4W
R90	RCB-AH68K-1	RD25S68KΩJ	R: FXD CAR 68kΩ ±5% 1/4W
R91	RVR-BE20K-1	X6T20KΩ	R: VAR WW 20kΩ
R92	RCB-AH12K-1	RD25S12KΩJ	R: FXD CAR 12kΩ ±5% 1/4W
R93	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R94	RCB-AH12K-1	RD25S12KΩJ	R: FXD CAR 12kΩ ±5% 1/4W
R95	RCB-AH150K-1	RD25S150KΩJ	R: FXD CAR 150kΩ ±5% 1/4W
R96			Not assigned
R97			Not assigned
R98	RCB-AH18K-1	RD25S18KΩJ	R: FXD CAR 18kΩ ±5% 1/4W
R99	RVR-CB100K-1	RJ6P100KΩ	R: VAR CERMET 100kΩ
R100	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R101	RCB-AH150-1	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R102	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R103	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R104	RCB-AH330-1	RD25S330ΩJ	R: FXD CAR 330Ω ±5% 1/4W
R105	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R106	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R107	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R108	RVR-BE2K-1	X6T2KΩ	R: VAR WW 2kΩ
R109	RMF-AR22KFK-1	SN14K2E22KΩF	R: FXD Metal FLM 22kΩ ±1% 1/4W
R110	RCB-AH12K-1	RD25S12KΩJ	R: FXD CAR 12kΩ ±5% 1/4W
C111	CTM-AC6P-1	ECV1ZW06X32	C: VAR CER 6pF
C112	CMC-AB5PR5K-2	DM10C050D5	C: FXD DIPPED MICA 5pF ±0.5% 500V
C113	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C114	CCP-ADR1U50V-1	C52AF1H104Z	C: FXD CHIP 0.1 μF +80, −20% 50V
C115	CCP-ADR1U50V-1	C52AF1H104Z	C: FXD CHIP 0.1 μF +80, −20% 50V
C116	CTA-AB10U25V-1	221M2502-106M	C: FXD ELECT TANTAL 10 μF ±20% 25V
C117	CMC-AB3PR5K-2	DM10C030D5	C: FXD DIPPED MICA 3pF
C118			Not assigned
C119	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C120	CSM-ACR0U50V-1	0.01UF50WV	C: FXD CER 0.01 μF +80, −20% 50V
C121			Not assigned
C122 thru C124	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01 μF +80, −20% 50V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C125	CSM-AC2200P50V-1	0.0022UF50WV	C: FXD CER 0.0022µF +80, -20% 50V
C126	CSM-AC10P50V-1	10PF50WV	C: FXD CER 10pF ±10% 50V
C127	CSM-AC8P50V-1	8PF50WV	C: FXD CER 8pF ±10% 50V
C128	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C129	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C130	CSM-AC2200P50V-1	0.0022UF50WV	C: FXD CER 0.0022µF +80, -20% 50V
C131	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C132	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C133	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047µF +80, -20% 50V
C134	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C135 thru C137	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047µF +80, -20% 50V
C138 thru C140	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C141	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001µF +80, -20% 50V
C142	CSM-AC220P50V-1	220PF50WV	C: FXD CER 220pF ±10% 50V
C143 thru C145	CSM-AC2200P50V-1	0.0022UF50WV	C: FXD CER 0.0022µF +80, -20% 50V
C146	CSM-AC220P50V-1	220PF50WV	C: FXD CER 220pF ±10% 50V
C147	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001µF +80, -20% 50V
C148	CTA-AB10U25V-1	221M2502-106M	C: FXD ELECT TANTAL 10µF ±20% 25V
C149	CTA-AB10U25V-1	221M2502-106M	C: FXD ELECT TANTAL 10µF ±20% 25V
C150			Not assigned
C151 thru C154	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C155	CTA-AE2R2U20V-1	NP20ST2R2	C: FXD BL 2.2µF 20V
C156	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01µF +80, -20%
C157	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10µF ±20% 16V
C158	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10µF ±20% 16V
C159 thru C162	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10µF 25V
C163	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C164	CMC-AB82PR3K-4	DM10D820J3	C: FXD DIPPED MICA 82pF ±5% 300V
C165	CMC-AB3PR5K-2	DM10C030D5	C: FXD DIPPED MICA 3pF ±0.5% 500V
C166	CSM-AC1P50V-1	1PF50WV	C: FXD CER 1pF ±10% 50V
L171 thru L173	LCL-B00371-1	TPF0410-330K	L: FXD Coil
L174	LCL-B00162-1	TP0410-2R2K	L: FXD Coil
L175	LCL-B00312-1	TP0410-R56K	L: FXD Coil
L176	LCL-B00365-1	TPF0410-3R3K	L: FXD Coil
L177	LCL-B00366-1	TPF0410-4R7K	L: FXD Coil
L178	LCL-B00366-1	TPF0410-4R7K	L: FXD Coil
L179	LCL-B00365-1	TPF0410-3R3K	L: FXD Coil
L180	LCL-T00084-1	*	L: FXD Coil
L181	LCL-C00012-1	CSL0609-471K	L: FXD Coil
L182	LCL-C00012-1	CSL0609-471K	L: FXD Coil

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
L183	DCB-QQ0042X01-1	MCT219(0.2M)	L: FXD Coil
L184	DCB-QQ0042X01-1	MCT219(0.2M)	L: FXD Coil
L185	LCL-A00059-1	LS17	L: FXD Coil
J191	JCF-AC001JX04-1	UM-R-PC	Coaxial Connector
R211	RCB-AH150K-1	RD25S150KΩJ	R: FXD CAR 150kΩ ±5% 1/4W
R212	RVR-BE2K-1	X6T2KΩ	R: VAR WW 2kΩ

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Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1	SIT-74LS160-9	SN74LS160N	IC: Synchronous 4-Bit Counter Low Power
IC2	SIT-74LS160-9	SN74LS160N	IC: Synchronous 4-Bit Counter Low Power
IC3	SIT-74LS00-9	SN74LS00N	IC: Quadruple 2-Input Positive-NAND Gate Low Power
IC4	SIT-74LS390-9	SN74LS390N	IC: Dual Decade Counter Low Power
IC5	SIT-74LS112	SN74LS112N	IC: Dual J-K Negative-Edge-Triggered Flip Flop with Preset AND Clear
IC6	SIA-DG201-1	DG201BK	IC: Quad Monolithic SPST CMOS Analog Switch
IC7	SIT-74LS00	SN74LS00N	IC: Quadruple 2-Input Positive-NAND Gate Low Power
IC8	SIA-TL072-1	TL072CP	IC: Low Noise Operational Amplifier
Q11	STN-2SC1730-1	2SC1730	Transistor SI NPN
Q12	STN-2SC1254-1	2SC1254	Transistor SI NPN
Q13	STN-2SC2026-1	2SC2026	Transistor SI NPN
Q14	STN-2SC1844-1	2SC1844	Transistor SI NPN
Q15	STN-2SC1844-1	2SC1844	Transistor SI NPN
Q16	STN-2SC1254-1	2SC1254	Transistor SI NPN
Q17	STN-2SC1254-1	2SC1254	Transistor SI NPN
Q18	STP-2SA711-1	2SA711	Transistor SI PNP
D21 thru D24	SDS-1S953-1	1S953	Diode SI
D25	SDS-1SS97-1	1SS97	Diode SI
D26	SDS-1SS97-1	1SS97	Diode SI
R31	RCB-AG5R6K-1	RD12S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/8W
R32	RCB-AG8R2K-1	RD12A8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/8W
R33	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R34	RCB-AG680-1	RD12S680ΩJ	R: FXD CAR 680Ω ±5% 1/8W
R35	RCB-AG51-1	RD12S51ΩJ	R: FXD CAR 51Ω ±5% 1/8W
R36	RCB-AG22-1	RD12S22ΩJ	R: FXD CAR 22Ω ±5% 1/8W
R37	RCB-AG2R2K-1	RD12S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/8W
R38	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R39	RCB-AG2R2K-1	RD12S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/8W
R40	RCB-AG120-1	RD12S120ΩJ	R: FXD CAR 120Ω ±5% 1/8W
R41	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R42	RCB-AG120-1	RD12S120ΩJ	R: FXD CAR 120Ω ±5% 1/8W
R43	RCB-AG4R7K-1	RD12S47KΩJ	R: FXD CAR 47kΩ ±5% 1/8W
R44	RCB-AG330-1	RD12S330ΩJ	R: FXD CAR 330Ω ±5% 1/8W
R45	RCB-AG51-1	RD12S51ΩJ	R: FXD CAR 51Ω ±5% 1/8W
R46	RCB-AG470-1	RD12S470ΩJ	R: FXD CAR 470Ω ±5% 1/8W
R47	RCB-AG220-1	RD12S220ΩJ	R: FXD CAR 220Ω ±5% 1/8W
R48	RCB-AG4R7K-1	RD12S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/8W
R49	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R50	RCB-AG4R7K-1	RD12S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/8W
R51	RCB-AG220-1	RD12S220ΩJ	R: FXD CAR 220Ω ±5% 1/8W
R52			Not assigned
R53	RCB-AG1R8K-1	RD12S1.8KΩJ	R: FXD CAR 1.8kΩ ±5% 1/8W
R54	RCB-AG27K-1	RD12S27KΩJ	R: FXD CAR 27kΩ ±5% 1/8W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R55 thru R57	RCB-AG470-1	RD12S470ΩJ	R: FXD CAR 470Ω ±5% 1/8W
C61 thru C63	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C64			Not assigned
C65	CSM-AC470P50V-1	470PF50WV	C: FXD CER 470pF ±10% 50V
C66	CSM-AC680P50V-1	680PF50WV	C: FXD CER 680pF ±10% 50V
C67	CSM-AC680P50V-1	680PF50WV	C: FXD CER 680pF ±10% 50V
C68	CSM-AC470P50V-1	470PF50WV	C: FXD CER 470pF ±10% 50V
C69 thru C76	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C77	CTA-AC10U16V	242M1602-106M	C: FXD ELECT TANTAL 10μF ±20% 16V
C78	CTA-AC10U16V	242M1602-106M	C: FXD ELECT TANTAL 10μF ±20% 16V
C79	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10μF ±20% 35V
C80	CMC-AB100PR3K-4	DM10D101J4	C: FXD DIPPED MICA 100pF ±5% 300V
C81	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C82	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10μF ±20% 35V
C83	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10μF ±20% 35V
C84	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C85	CTA-AE1U35V-1	NP35ST1RO	C: FXD BL 1μF 35V
C86 thru C88	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C89	CSM-AC6800P50V-1	0.0068UF50WV	C: FXD CER 0.0068μF +80, -20% 50V
C90	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C91	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10μF 25V
C92	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10μF 25V
C93	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C94	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10μF 25V
C95	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10μF 25V
C96			Not assigned
C97			Not assigned
C98	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10μF ±20% 16V
C99	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10μF ±20% 16V
L101	LCL-B00362-1	TPF0410-1R0K	L: FXD Coil
L102	LCL-B00493-1	TPF0410-1R2K	L: FXD Coil
L103	LCL-B00362-1	TPF0410-1R0K	L: FXD Coil
L104	LCL-B00348-1	TP0410-680J	L: FXD Coil
L105	LCL-B00348-1	TP0410-680J	L: FXD Coil
L106	LCL-C00012-1	CSL0609-471K	L: FXD Coil
L107	LCL-C00012-1	CSL0609-471K	L: FXD Coil
L108	LCL-T00084-1	*	L: FXD Coil
L109	LCL-B00159-1	TP0410-102J	L: FXD Coil
T121	ESM-000129-1	Q5BRH3.4X3X1	Transformer
T122	ESM-000129-1	Q5BRH3.4X3X1	Transformer
T123	LCL-T00480-1	*	Transformer
T124	ESM-000129-1	Q5BRH3.4X3X1	Transformer

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
MIX127	DEE-000736-1	*	Mixer
J131	JCF-AC001JX04-1	UM-R-PC	Coaxial Connector
J132	JCF-AC001JX04-1	UM-R-PC	Coaxial Connector
R135	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R136	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R137	RCB-AG1R5K-1	RD12S1.5KΩJ	R: FXD CAR 1.5kΩ ±5% 1/8W
R138 thru R141	RCB-AG10K-1	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R142	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
C151	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01uF +80, -20% 50V
C152	CFM-ACR22UR1K-2	432A1003-224K	C: FXD Mylar 22uF ±10% 1KV
C153	CMC-AC680PR3K-2	DM15D681J3	C: FXD DIPPED MICA 680pF ±5% 300V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
FL1 thru FL28	DNF-000601-1	*	Filter
FL29			Not assigned
FL30 thru FL33	DNF-000601-1	*	Filter
P45	JTF-AB001EX04-1	PF-5-175	Teflon Terminal
P46	JTF-AB001EX04-1	PF-5-175	Teflon Terminal
J57 thru J64	JCF-AC001JX02-2	UM-QR	Connector
J65	JCF-AA001JX20-2	50-645-4526-89	Coaxial Connector
J66	JCF-AA001JX20-2	50-645-4526-89	Coaxial Connector
J67	JCF-AC001JX02-2	UM-QR	Connector
J68 thru J72	JCF-AA001JX20-2	50-645-4526-89	Coaxial Connector
J73 thru J90			Not assigned
J91	JCF-AC001JX02-2	UM-QR	Connector
J92	JCF-AC001JX02-2	UM-QR	Connector
J93 thru J100			Not assigned
J101	DCB-QR1043X01-1	HIF-20P-C040HENC	Cable
J102	JCS-AD005PX05-1	PCN6B-59-2.5E	Connector

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Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
Q1 thru Q3	STN-2SC2585-1	2SC2585	Transistor Si NPN
R11	RCB-AH1R5K-1	RD25S1.5KΩJ	R: FXD CAR 1.5kΩ ±5% 1/4W
R12	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R13	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R14	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R15	RCB-AH1R5K-1	RD25S1.5KΩJ	R: FXD CAR 1.5kΩ ±5% 1/4W
R16	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R17	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R18	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R19	RCB-AH1R5K-1	RD25S1.5KΩJ	R: FXD CAR 1.5kΩ ±5% 1/4W
R20	RCB-AH3R9K	RD25S3.9KΩJ	R: FXD CAR 3.9kΩ ±5% 1/4W
R21	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R22	RCB-AH330-1	RD25S330ΩJ	R: FXD CAR 330Ω ±5% 1/4W
R23 thru R25	DHB-000332-1	*	R: 3dB PAD
C31	CCP-ADR01U50V-1	C52AF1H103Z	C: FXD CHIP 0.01μF +80, -20% 50V
C32			Not assigned
C33	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C34	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C35			Not assigned
C36 thru C38	CCP-ADR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C39			Not assigned
C40	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C41	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C42			Not assigned
C43 thru C45	CCP-ADR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C46			Not assigned
C47	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C48	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C49			Not assigned
C50 thru C52	CCP-ADR01U50V-1	0.01UF50WV	C: FXD CHIP 0.01μF +80, -20% 50V
C53			Not assigned
C54	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C55	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10μF ±20% 35V
C56	CCP-ACR5P50V-4	C2012COG1HOR5C	C: FXD CHIP 5pF ±0.25% 50V
L61	LCL-C00012-1	CSL0609-471K	L: FXD Coil 470μH

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Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
D1	SDS-S3015-2	S3015B	Diode SI
R11	DHB-000332-1	*	R: 3dB PAD
R12	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R13	RVR-AK10K-1	3321H-1-103	R: VAR CERMET 10kΩ
R14	DHB-000333-1	*	R: 6dB PAD
C21	CCP-ADR01U50V-1	C52AF1H103Z	C: FXD CHIP 0.01µF +80, -20% 50V
C22	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C23	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10µF ±20% 35V
C24	CTM-AA10P-1	ECV1ZW10X53N	C: VAR CER 10pF
C25	CTM-AA10P-1	ECV1ZW10X53N	C: VAR CER 10pF
C26	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C27	CCP-AC10P50V-6	C2012C0G1H100D	C: FXD CHIP 10pF 50V
C28	CCP-AC10P50V-6	C2012C0G1H100D	C: FXD CHIP 10pF 50V
C29	CSM-AC1P50V-1	1PF50WV	C: FXD CER 1pF ±10% 50V
L31	LCL-C00012-1	CSL0609-471K	L: FXD Coil
L32	LCL-A00059-1	LS17	L: FXD Coil
L33	LCL-A00059-1	LS17	L: FXD Coil

TR4172
100/101MHz OSCILLATOR
BLC-010115

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
Q2	STN-2SC1844-1	2SC1844	Transistor SI NPN
Q3	STN-2SC1844-1	2SC1844	Transistor SI NPN
Q4	STN-2SC1254-1	2SC1254	Transistor SI NPN
Q5	STN-2SC1844-1	2SC1844	Transistor SI NPN
Q6	STN-2SC1844-1	2SC1844	Transistor SI NPN
Q7	STN-2SC1254-1	2SC1254	Transistor SI NPN
Q8	STN-2SC1254-1	2SC1254	Transistor SI NPN
Q9	STN-2SC1426-1	2SC1426	Transistor SI NPN
Q10	STN-2SC1254-1	2SC1254	Transistor SI NPN
R23	RCB-AH15K-1	RD25S15KΩJ	R: FXD CAR 15kΩ ±5% 1/4W
R24	RCB-AH2R7K	RD25S2.7KΩJ	R: FXD CAR 2.7kΩ ±5% 1/4W
R25	RCB-AH15K-1	RD25S15KΩJ	R: FXD CAR 15kΩ ±5% 1/4W
R26	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R27	RCB-AH15K-1	RD25S15KΩJ	R: FXD CAR 15kΩ ±5% 1/4W
R28	RCB-AH2R7K	RD25S2.7KΩJ	R: FXD CAR 2.7kΩ ±5% 1/4W
R29	RCB-AH15K-1	RD25S15KΩJ	R: FXD CAR 15kΩ ±5% 1/4W
R30	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R31	RCB-AH8R2K-1	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R32	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R33	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R34	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R35	RCB-AH8R2K-1	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R36	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R37	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R38	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R39	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R40	RCB-AH8R2K-1	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R41	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R42	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R43	RCB-AH680-1	RD25S680ΩJ	R: FXD CAR 680Ω ±5% 1/4W
R44	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R45	RCB-AH8R2K-1	RD25S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/4W
R46	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R47	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R48	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R49			Not assigned
R50			Not assigned
R51	RCB-AK330-1	RD50S330ΩJ	R: FXD CAR 330Ω ±5% 1/2W
R52	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R53	RCB-AH51	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R54	RCB-AH51	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R55 thru R59	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
C61	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CAR 0.01μF +80, -20% 50V
C62	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CAR 0.01μF +80, -20% 50V
C63			Not assigned
C64	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C65			Not assigned
C66	CSM-AC2200P50V-1	0.0022UF50WV	C: FXD CER 0.0022μF +80, -20% 50V
C67	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C68	CSM-AC2200P50V-1	0.0022UF50WV	C: FXD CER 0.0022μF +80, -20% 50V
C69	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C70	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C71	CSM-AC2200P50V-1	0.0022UF50WV	C: FXD CER 0.0022μF +80, -20% 50V
C72	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C73	CSM-AC2200P50V-1	0.0022UF50WV	C: FXD CER 0.0022μF +80, -20% 50V
C74	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C75	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C76	CSM-AC2200P50V-1	0.0022UF50WV	C: FXD CER 0.0022μF +80, -20% 50V
C77	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C78	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C79	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C80	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C81	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C82	CTM-AC20P-1	ECV1ZW20X32	C: VAR CER 20pF
C83			Not assigned
C84	CMC-AB10PR5K-6	DM10C100K5	C: FXD DIPPED MICA 10pF ±10% 500V
C85	CTA-AB10U35V-1	111M3502-106M	C: FXD ELECT TANTAL 10μF ±20% 35V
C86	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C87	CTM-AC20P-1	ECV1ZW20X32	C: VAR CER 20pF
C88	CTM-AC20P-1	ECV1ZW20X32	C: VAR CER 20pF
C89	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C90	CTA-AB10U35V-1	111M3502-106M	C: FXD ELECT TANTAL 10μF ±20% 35V
C91 thru C94	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10μF 25V
C95	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C96	CSM-AC2200P50V-1	0.0022UF50WV	C: FXD CER 0.0022μF +80, -20% 50V
C97	CSM-AC3P50V-1	3PF50WV	C: FXD CER 3pF ±10% 50V
C98	CSM-AC3P50V-1	3PF50WV	C: FXD CER 3pF ±10% 50V
L101	LCL-A00063-1	LS21	L: FXD Coil
L102	LCL-B00371-1	TPF0410-330K	L: FXD Coil
L103	LCL-A00063-1	LS21	L: FXD Coil
L104	LCL-C00012-1	CSL0609-471K	L: FXD Coil
L105	LCL-C00012-1	CSL0609-471K	L: FXD Coil
L106			Not assigned
L107			Not assigned
X111			Not assigned
X112			Not assigned
J115	JCF-AC001JX04-1	UM-R-PC	Connector
J116	JCF-AC001JX04-1	UM-R-PC	Connector
IC121	SIA-5534A-1	NE5534AN	IC: Low Noise Operational Amplifier
D126 thru D129	SDS-1S2222-1	1S2222	Diode SI

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R135	RCB-AH1K	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R136	RCB-AH1K	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R137	RCB-AH100	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R138	RCB-AH100	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W

TR4172
1st 1OCAL MIXER
BLB-010116

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
D1	SDS-D5847-1	D5847	Diode SI
C5	CMC-AB82PR3K-4	DM10D820J3	C: FXD DIPPED MICA 82pF ±5% 300V
C6	CMC-AB150PR3K-4	DM10D151J3	C: FXD DIPPED MICA 150pF ±5% 300V
C7	CMC-AB150PR3K-4	DM10D151J3	C: FXD DIPPED MICA 150pF ±5% 300V
C8	CMC-AB82PR3K-4	DM10D820J3	C: FXD DIPPED MICA 82pF ±5% 300V
L11	LCL-A00069-1	LS27	L: FXD Coil
L12	LCL-A00070-1	LS28	L: FXD Coil
L13	LCL-A00069-1	LS27	L: FXD Coil
L14	LCL-A00062-1	LS20	L: FXD Coil
CBL	DCB-QQ0042X01-1	MCT219(0.2M)	Cable

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1	SI74S00-9	SN74S00N	IC: Quadruple 2-Input Positive NAND Gate Low Power
IC2	SIA-TL082-1	TL082CP	IC: Dual Operational Amplifier
Q11	STN-2SC1426-1	2SC1426	Transistor SI NPN
Q12	STN-2SC1426-1	2SC1426	Transistor SI NPN
Q13	STN-2SC1254-1	2SC1254	Transistor SI NPN
Q14	STN-2SC1254-1	2SC1254	Transistor SI NPN
Q15	STP-2SA711-1	2SA711	Transistor SI PNP
Q16	SFN-2N4859-18	2N4859	Transistor SI PNP
Q17 thru Q19	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
D21	SDS-1SS97-1	1SS97	Diode SI
D22	SDS-1SS97-1	1SS97	Diode SI
D23	SDS-1S953-1	1S953	Diode SI
D24	SDS-LD1-1	LD-1	Diode SI
D25	SDS-1S953-1	1S953	Diode SI
R31	RCB-AG470-1	RD12S470ΩJ	R: FXD CAR 470Ω ±5% 1/8W
R32	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R33	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R34	RCB-AG15-1	RD12S15ΩJ	R: FXD CAR 15Ω ±5% 1/8W
R35	RCB-AG2R2K-1	RD12S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/8W
R36	RCB-AG51-1	RD12S51ΩJ	R: FXD CAR 51Ω ±5% 1/8W
R37	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R38	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R39	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R40	RMF-AC15KFJ-1	RF1/8N15KΩSF	R: FXD Metal FLM 15kΩ ±1% 1/8W
R41 thru R43			Not assigned
R44	RMF-AC100QFT-1	RF1/8N100ΩSF	R: FXD Metal FLM 100Ω ±1% 1/8W
R45	RMF-AC10QFJ-1	RF1/8N10ΩSF	R: FXD Metal FLM 10Ω ±1% 1/8W
R46	RMF-AC10QFJ-1	RF1/8N10ΩSF	R: FXD Metal FLM 10Ω ±1% 1/8W
R47	RMF-AC100QFJ-1	RF1/8N100ΩSF	R: FXD Metal FLM 100Ω ±1% 1/8W
R48	RMF-AC100QFJ-1	RF1/8N100ΩSF	R: FXD Metal FLM 100Ω ±1% 1/8W
R49	RMF-AC56QFJ-1	RF1/8N56ΩSF	R: FXD Metal 56Ω ±1% 1/8W
R50	RMF-AC47QFJ-1	RF1/8N47ΩSF	R: FXD Metal FLM 47Ω ±1% 1/8W
R51			Not assigned
R52	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R53	RCB-AG820K-1	RD12S820KΩJ	R: FXD CAR 820kΩ ±5% 1/8W
R54	RCB-AG10K-1	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R55	RCB-AG4R7K-1	RD12S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/8W
R56	RCB-AG2R2K-1	RD12S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/8W
R57	RCB-AG22K-1	RD12S22KΩJ	R: FXD CAR 22kΩ ±5% 1/8W
R58	RCB-AG10-1	RD12S10ΩJ	R: FXD CAR 10Ω ±5% 1/8W
R59	RCB-AG820K-1	RD12S820KΩJ	R: FXD CAR 820kΩ ±5% 1/8W
R60	RCB-AG3R3K-1	RD12S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/8W
R61	RMF-AC180QFJ	RF1/8N180ΩSF	R: FXD Metal FLM 180Ω ±1% 1/8W
R62			Not assigned

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Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R63	RMF-AC180QFJ	RF1/8N180ΩSF	R: FXD Metal FLM 180Ω ±1% 1/8W
R64	RMF-AC180QFJ-1	RF1/8N180ΩSF	R: FXD Metal FLM 180Ω ±1% 1/8W
C71	CMC-AB20PR5K-6	DM10C200K5	C: FXD DIPPED MICA 20pF ±10% 500V
C72 thru C75	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C76	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10μF ±20% 35V
C77	CMC-AB68PR3K-4	DM10D680J3	C: FXD DIPPED MICA 68pF ±5% 300V
C78	CMC-AB120PR3K-4	DM10D121J3	C: FXD DIPPED MICA 120pF ±5% 300V
C79	CMC-AB120PR3K-4	DM10D121J3	C? FXD DIPPED MICA 120pF ±5% 300V
C80	CMC-AB68PR3K-4	DM10D680J3	C: FXD DIPPED MICA 68pF ±5% 300V
C81	CSM-AC680P50V-1	680PF50WV	C: FXD CER 680pF ±10% 50V
C82	CSM-AC330P50V-1	330PF50WV	C: FXD CER 330pF ±10% 50V
C83	CSM-AC680P50V-1	680PF50WV	C: FXD CER 680pF ±10% 50V
C84	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10μF ±20% 35V
C85	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C86	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C87 thru C89			Not assigned
C90	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10μF ±20% 35V
C91	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C92	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10μF 25V
C93	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C94	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C95			Not assigned
C96 thru C101	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10μF 25V
C102	CTA-AE1U35V-1	NP35ST1R0	C: FXD ELECT TANTAL 1μF 35V
C103 thru C105	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
L111	LCL-C00117-1	*	L: FXD Coil
L112 thru L114	LCL-B00155-1	TP0410-R22M	L: FXD Coil
L115	LCL-B00362-1	TPF0410-1R0K	L: FXD Coil
L116	LCL-B00362-1	TPF0410-1R0K	L: FXD Coil
L117			Not assigned
L118	LCL-C00012-1	CSL0609-471K	L: FXD Coil
L119	LCL-C00012-1	CSL0609-471K	L: FXD Coil
L120	LCL-T00084-1	*	L: FXD Coil

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1	SIT-74S00	SN74S00N	IC: Quadruple 2-Input Positive-NAND Gate
IC2	SIT-74S74-9	SN74S74N	IC: Dual D-Type Positive-Edge-Triggered Flip Flop with Preset AND Clear
IC3	SIT-74S162	SN74S162N	IC: Synchronous 4-bit Counter
IC4	SIT-74S162	SN74S162N	IC: Synchronous 4-bit Counter
IC5	SIT-74LS00-9	SN74LS00N	IC: Quadruple 2-Input Positive-NAND Gate Low Power
IC6	SIT-74LS00-9	SN74LS00N	IC: Quadruple 2-Input Positive-NAND Gate Low Power
IC7	SIT-74LS112-9	SN74LS112N	IC: Dual J-K Negative-Edge-Triggered Flip Flop with Preset AND Clear
IC8	SIT-74LS390-9	SN74LS390N	IC: Dual Decade Counter Low Power
IC9	SIT-74LS26	SN74LS26N	IC: Quadruple 2-Input High Voltage Interface Positive-NAND Gate Low Power
Q21	STN-2SC1426-1	2SC1426	Transistor SI NPN
Q22	STN-2SC1254-1	2SC1254	Transistor SI NPN
Q23	STN-2SC1254-1	2SC1254	Transistor SI NPN
Q24	STN-2SC1730-1	2SC1730	Transistor SI NPN
Q25	STN-2SC1730-1	2SC1730	Transistor SI NPN
Q26 thru Q28	STN-2SC1254-1	2SC1254	Transistor SI NPN
Q29	STN-2SA711-1	2SA711	Transistor SI PNP
Q30	STP-2SA711-1	2SA711	Transistor SI PNP
Q31	STN-2SC1254-1	2SC1254	Transistor SI NPN
Q32	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q33	STN-2SC1815-15	2SC1815GR	Transistor Si NPN
D41 thru D43	SDS-1S2222-1	1S2222	Diode SI
D44	SDS-1S953-1	1S953	Diode SI
D45	SDS-1S953-1	1S953	Diode SI
D46			Not assigned
D47			Not assigned
R61	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R62	RCB-AG8R2K-1	RD12S8.2KΩJ	R: FXD CAR 8.2kΩ ±5% 1/8W
R63	RCB-AG10K-1	RD12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R64	RCB-AG220-1	RD12S220ΩJ	R: FXD CAR 220Ω ±5% 1/8W
R65	RCB-AG390-1	RD12S390ΩJ	R: FXD CAR 390Ω ±5% 1/8W
R66	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R67	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R68			Not assigned
R69			Not assigned
R70	RCB-AG2R2K-1	RD12S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/8W
R71	RCB-AG220-1	RD12S220ΩJ	R: FXD CAR 220Ω ±5% 1/8W
R72	RCB-AG33-1	RD12S33ΩJ	R: FXD CAR 33Ω ±5% 1/8W
R73	RCB-AG3R3K-1	RD12S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/8W
R74	RCB-AG5R6K-1	RD12S5.6KΩ	R: FXD CAR 5.6kΩ ±5% 1/8W
R75	RCB-AG220-1	RD12S220ΩJ	R: FXD CAR 220Ω ±5% 1/8W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R76	RCB-AG5R6K-1	RD12S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/8W
R77	RCB-AG3R3K-1	RD12S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/8W
R78	RCB-AG2R2K-1	RD12S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/8W
R79	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R80	RCB-AG220-1	RD12S220ΩJ	R: FXD CAR 220Ω ±5% 1/8W
R81	RCB-AG33-1	RD12S33ΩJ	R: FXD CAR 33Ω ±5% 1/8W
R82	RCB-AG220-1	RD12S220ΩJ	R: FXD CAR 220Ω ±5% 1/8W
R83	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R84	RCB-AH1R2K-1	RD25S1.2KΩJ	R: FXD CAR 1.2kΩ ±5% 1/4W
R85	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R86	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R87	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R88	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R89	RCB-AG560-1	RD12S560ΩJ	R: FXD CAR 560Ω ±5% 1/8W
R90	RCB-AG3R3K-1	RD12S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/8W
R91	RCB-AG2R2K-1	RD12S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/8W
R92	RCB-AG5R6K-1	RD12S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/8W
R93	RCB-AG3R3K-1	RD12S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/8W
R94	RMF-AC2R2KFJ-1	RF1/8N2.2KΩSF	R: FXD Metal FLM 2.2kΩ ±1% 1/8W
R95	RMF-AC2R2KFJ-1	RF1/8N2.2KΩSF	R: FXD Metal FLM 2.2kΩ ±1% 1/8W
R96 thru R98	RMF-AC1KFJ	RF1/8N1KΩSF	R: FXD Metal FLM 1kΩ ±1% 1/8W
R99	RMF-AC22KFJ	RF1/8N22KΩSF	R: FXD Metal FLM 22kΩ ±1% 1/8W
R100	RMF-AC1KFJ	RF1/8N1KΩSF	R: FXD Metal FLM 1kΩ ±1% 1/8W
R101	RCB-AG100	RD12S100ΩJ	R: FXD Metal FLM 100Ω ±5% 1/8W
R102	RCB-AG100-1	RD12S100ΩJ	R: FXD CAR 100Ω ±5% 1/8W
R103	RCB-AG100	RCB12S100ΩJ	R: FXD Metal FLM 100Ω ±5% 1/8W
R104	RMF-AC330QFJ	RF1/8N330ΩSF	R: FXD Metal FLM 330Ω ±1% 1/8W
R105 thru R108	RCB-AG10K-1	R12S10KΩJ	R: FXD CAR 10kΩ ±5% 1/8W
R109	RMF-AC330QFJ	RF1/8N330QSF	R: FXD Metal FLM 330Ω ±1% 1/8W
R110	RMF-AC330QFJ	RF1/8N330QSF	R: FXD Metal FLM 330Ω ±1% 1/8W
C111 thru C113	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C114	CSM-AGR1U50V-1	FD76AF1H104Z	C: FXD CER 0.1μF +80, -20% 50V
C115	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10μF ±20% 35V
C116 thru C120	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C121	CSM-AC33P50V-1	33PF50WV	C: FXD CER 33pF ±10% 50V
C122	CSM-AC180P50V-1	180PF50WV	C: FXD CER 180pF ±10% 50V
C123	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C124	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C125			Not assigned
C126 thru C128	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C129	CSM-AC180P50V-1	180PF50WV	C: FXD CER 180pF ±10% 50V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C130	CSM-AC33P50V-1	33PF50WV	C: FXD CER 33pF ±10% 50V
C131 thru C137	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C138	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10μF ±20% 35V
C139	CTA-AC10U16V	242M1602-106M	C: FXD ELECT 10μF ±20% 16V
C140	CTA-AE2R2U35V-1	NP35ST2R2	C: FXD BL 2.2μF 35V
C141	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10μF ±20% 35V
C142 thru C149	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C150 thru C155	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10μF 25V
C156 thru C158	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
L161	LCL-T00084-1	*	L: FXD Coil
L162	LCL-C00012-1	CSL0609-471K	L: FXD Coil
L163	LCL-C00012-1	CSL0609-471K	L: FXD Coil
T175	ESM-000129-1	Q5BRH3.4X3X1	Core

TR4172
PLL FILTER
BLB-010119

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1	SIA-TL072-1	TL072CP	IC: Low Noise JFET Input Operational Amplifier
R11	RMF-AR5R1KFK-1	RF1/8N5.1KΩSF	R: FXD Metal FLM 5.1kΩ ±1% 1/8W
R12	RMF-AR5R1KFK-1	RF1/8N5.1KΩSF	R: FXD Metal FLM 5.1kΩ ±1% 1/8W
C21	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C22	CSM-ACR047U50V	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C23	CMC-AB100PR3K-4	DM10D101J3	C: FXD DIPPED MICA 100pF ±5% 300V
C24	CMC-AC470PR3K-2	DM15D471J3	C: FXD DIPPED MICA 470pF ±5% 300V
C25	CMC-AD2000PR3K-2	DM19D202J3	C: FXD DIPPED MICA 2000pF ±5% 300V
C26	CMC-AD4700PR3K-2	DM19D472J3	C: FXD DIPPED MICA 4700pF ±5% 300V
C27	CMC-AD3300PR3K-2	DM19D332J3	C: FXD DIPPED MICA 3300pF ±5% 300V
C28 thru C30	CFM-ASR022U50V-1	505N5002-223K	C: FXD Mylar 0.022μF ±10% 50V
C31 thru C34	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10μF 25V
L41 thru L43	LCL-C00120-1	L10A1	L: FXD Coil
L44	LCL-B00347-1	TP0410-470J	L: FXD Coil
L45	LCL-B00168-1	TP0410-750J	L: FXD Coil
L46	LCL-B00168-1	TP0410-750J	L: FXD Coil
L47	LCL-B00347-1	TP0410-470J	L: FXD Coil
L48	LCL-C00012-1	CSL0609-471K	L: FXD Coil
L49	LCL-C00012-1	CSL0609-471K	L: FXD Coil

TR4172
100/101MHz OSC. PLL
BLB-010120

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1	SIT-74LS160-9	SN74LS160N	IC: Synchronous 4-bit Counter Low Power
IC2	SIT-74LS112-9	SN74LS112N	IC: Dual J-K Negative Edge-Triggered Flip-Flop with Preset and Clear Low Power
IC3	SIT-74LS00-9	SN74LS00N	IC: Quadruple 2-Input NAND Gate Low Power
IC4	SIT-74LS390-9	SN74LS390N	IC: Dual Decode Counter
Q11 thru Q13	STN-2SC1254-1	2SC1254	Transistor SI NPN
Q14	STN-2SC2026-1	2SC2026	Transistor SI NPN
Q15	STN-2SC2026-1	2SC2026	Transistor SI NPN
Q16			Not assigned
Q17	STN-2SC1815-15	2SC1815GR	Transistor SI NPN
Q18	STN-2SC1254-1	2SC1254	Transistor SI NPN
Q19	STN-2SC1254-1	2SC1254	Transistor SI NPN
Q20	STP-2SA711-1	2SA711	Transistor SI PNP
D25 thru D28	SDS-1S953-1	1S953	Diode SI
R31	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R32	RCB-AH33K-1	RD25S33KΩJ	R: FXD CAR 33kΩ ±5% 1/4W
R33	RCB-AH33K-1	RD25S33KΩJ	R: FXD CAR 33kΩ ±5% 1/4W
R34	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R35	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R36			Not assigned
R37	RCB-AH15K-1	RD25S15KΩJ	R: FXD CAR 15kΩ ±5% 1/4W
R38	RCB-AH15K-1	RD25S15KΩJ	R: FXD CAR 15kΩ ±5% 1/4W
R39	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R40	RCB-AH680-1	RD25S680ΩJ	R: FXD CAR 680Ω ±5% 1/4W
R41	RCB-AH22-1	RD25S22ΩJ	R: FXD CAR 22Ω ±5% 1/4W
R42	RCB-AH33-1	RD25S33ΩJ	R: FXD CAR 33Ω ±5% 1/4W
R43	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R44	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R45	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R46	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R47	RCB-AH22-1	RD25S22ΩJ	R: FXD CAR 22Ω ±5% 1/4W
R48	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R49	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R50	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R51	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R52	RCB-AH150-1	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R53	RCB-AH10-1	RD25S10ΩJ	R: FXD CAR 10Ω ±5% 1/4W
R54	RCB-AH270-1	RD25S270ΩJ	R: FXD CAR 270Ω ±5% 1/4W
R55	RCB-AH22-1	RD25S22ΩJ	R: FXD CAR 22Ω ±5% 1/4W
R56	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R57	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R58	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R59	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R60 thru R64			Not assigned

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R65	RCB-AH33K-1	RD25S33KΩJ	R: FXD CAR 33kΩ ±5% 1/4W
R66	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R67 thru R70			Not assigned
R71	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R72	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R73	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R74	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
C81 thru C83	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C84	CMC-AB56PR3K-4	DM10D560J3	C: FXD DIPPED MICA 56pF ±5% 300V
C85	CMC-AB1PR5K-2	DM10C010D5	C: FXD DIPPED MICA 1pF ±0.5% 500V
C86	CMC-AB15PR5K-6	DM10C150K5	C: FXD DIPPED MICA 15pF ±10% 500V
C87	CMC-AB1PR5K-2	DM10C010D5	C: FXD DIPPED MICA 1pF ±0.5% 500V
C88	CMC-AB15PR5K-6	DM10C150K5	C: FXD DIPPED MICA 15pF ±10% 500V
C89 thru C91	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C92	CMC-AB10PR5K-6	DM10C100K5	C: FXD DIPPED MICA 10pF ±10% 500V
C93	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C94	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C95	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C96	CTM-AB20P-1	ECV1ZW20X31	C: VAR CER 20pF
C97	CMC-AB1PR5K-2	DM10C010D5	C: FXD DIPPED MICA 1pF ±0.5% 500V
C98	CTM-AB20P-1	ECV1ZW20X31	C: VAR CER 20pF
C99	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C100	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C101	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C102	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C103	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C104	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C105	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C106	CMC-AC820PR3K-2	DM15D821J3	C: FXD DIPPED MICA 820pF ±5% 300V
C107	CMC-AC1200PR3K-2	DM15D122J3	C: FXD DIPPED MICA 1200pF ±5% 300V
C108	CMC-AC820PR3K-2	DM15D821J3	C: FXD DIPPED MICA 820pF ±5% 300V
C109	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C110	CMC-AD2000PR3K-2	DM19D202J3	C: FXD DIPPED MICA 2000pF ±5% 300V
C111			Not assigned
C112			Not assigned
C113	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C114			Not assigned
C115	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C116	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10uF ±20% 35V
C117 thru C120	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10uF 25V
C121	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C122	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C123	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10µF ±20% 16V
C124	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10µF ±20% 16V
C125	CMC-AB1PR5K-2	DM10C010D5	C: FXD DIPPED MICA 1pF ±0.5% 500V
C126	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10µF ±20% 35V
C127	CTA-AE22U20V-1	NP20ST220	C: FXD BL 22µF 20V
L131 thru L134	LCL-C00111-1	*	L: FXD Coil
L135	LCL-B00038-1	*	L: FXD Coil
L136			Not assigned
L137	LCL-B00364-1	TPF0410-2R2K	L: FXD Coil
L138	LCL-B00364-1	TPF0410-2R2K	L: FXD Coil
L139	LCL-C00012-1	CSL0609-471K	L: FXD Coil
L140	LCL-C00012-1	CSL0609-471K	L: FXD Coil
L141	LCL-T00084-1	*	L: FXD Coil
L142	LCL-B00494-1	TPF0410-120K	L: FXD Coil
J161	JCF-AC001JX04-1	UM-R-PC	Connector
M171	DEE-000736-1	*	Mixer
R176	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R177	RCB-AH4R7K-1	RD25S4.7KΩJ	R: FXD CAR 4.7kΩ ±5% 1/4W
R178	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R179	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R180	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1kΩ ±5% 1/4W
R181	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R182	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R183	RCB-AH1K-1	RD25S1KΩJ	R: FXD CAR 1KΩ ±5% 1/4W
T153	ESM-000129-1	Q5BRH3.4X3X1	Core

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
FL1 thru FL11	DNF-000601-1	ZFN5101-01R	Filter
J41	JCF-AC001JX02-2	UM-QR(01)	Connector
J42	JCF-AA001JX02-2	50-645-4527-89	Connector
J43 thru J51	JCF-AC001JX02-2	UM-QR(01)	Connector
J52 thru J59			Not assigned
J60	DCB-QR1042X01-1	MIF320PD-C035HENC/NL	Connector
J61	JCS-AD005PX05-1	PCN6B-5P-2.5E	Connector
J62	JCS-AD010PX05-1	PCN6B-10P-2.5E	Connector
J63	JCS-AD010JX01-1	PCN6-10S-2.5E	Connector
P71 thru P79	JTF-AB001EX04-1	PF-5-175	Teflon Terminal

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
IC1	SHB-000176-1	*	IC: Shumit Trigger IC
IC2	SIC-8619-1	SP8619B	IC: High Speed Divider
IC3	SIA-7905U-5	UPC7905H	IC: Voltage Regulator
IC4	SIC-10H102-1	MC10H102L	IC: 750MHz D Flip-Flop
IC5	SIC-10H102-1	MC10H102L	IC: Quad 2-Input NOR Gate
IC6	SIT-74LS05-9	SN74LS05N	IC: Hex Inverter with Open-Collector Output Low Power
IC7	SIC-10231-1	MC10231L	IC: Dual Type D Master-Slave Flip Flop
IC8	SIC-10131-1	MC10131L	IC: Dual Type D Master-Slave Flip Flop
IC9	SIC-10131-1	MC10131L	IC: Dual Type D Master-Slave Flip Flop
IC10	SIT-74LS86-9	SN74LS86N	IC: Quadruple 2-Input Exclusive-OR Gate Low Power
IC11	SIT-74LS73-9	SN74LS73N	IC: Dual J-K Flip Flop with Clear
IC12	SIT-15507-1	*	IC: LSI
IC13	SIM-60114-1	*	IC: LSI
IC14	SIT-74LS04-9	SN74LS04N	IC: Hex Inverter
IC15	SIT-74LS390-9	SN74LS390N	IC: Dual Decade Counter
IC16	SIT-74LS390-9	SN74LS390N	IC: Dual Decade Counter
IC17	SIT-74LS151-9	SN74LS151N	IC: 1-of-8 Data Selector/Multiplexer Low Power
IC18	SIT-74LS04-9	SN74LS04N	IC: Hex Inverter Low Power
Q21	STN-2SC2150-1	2SC2150	Transistor SI NPN
Q22	STN-2SC2150-1	2SC2150	Transistor SI NPN
Q23	STP-2SA1015-1	2SA1015	Transistor SI PNP
Q24	STP-2SA1015-1	2SA1015	Transistor SI PNP
Q25	STP-2SA711-1	2SA711	Transistor SI PNP
Q26	STP-2SA1015-1	2SA1015	Transistor SI PNP
Q27	STN-2SC1815-15	2SC1815	Transistor SI NPN
D52 thru D54	SDS-1S953-1	1S953	Diode SI
R61	DHB-000333-1	*	R: 6dB PAD
R62	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R63	RCB-AH5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R64	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R65	RCB-AH82	RD25S82ΩJ	R: FXD CAR 82Ω ±5% 1/4W
R66	RCB-AH220	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R67	RCB-AH150-1	RD25S150ΩJ	R: FXD CAR 150Ω ±5% 1/4W
R68	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R69	RCB-AH3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R70	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R71	RCB-AH120-1	RD25S120ΩJ	R: FXD CAR 120Ω ±5% 1/4W
R72	RCB-AH220-1	RD25S220ΩJ	R: FXD CAR 220Ω ±5% 1/4W
R73			Not assigned
R74			Not assigned
R75	RVR-BE10K-1	X6T10KΩ	R: VAR WW 10kΩ
R76	RCB-AH2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R77	RCB-AH51-1	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R78	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R79	RMF-AR10QFK-1	SN14K2E10ΩF	R: FXD Metal FLM 10Ω ±1% 1/4W
R80	RVR-BE100-1	X6T100Ω	R: VAR WW 100Ω
R81	RMF-AR120QFK-1	SN14K2E120ΩF	R: FXD Metal FLM 120Ω ±1% 1/4W
R82	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R83	RCB-AG51-1	RD12S51ΩJ	R: FXD CAR 51Ω ±5% 1/8W
R84	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R85	RCB-AH180-1	RD25S180ΩJ	R: FXD CAR 180Ω ±5% 1/4W
R86	RCB-AH270-1	RD25S270ΩJ	R: FXD CAR 270Ω ±5% 1/4W
R87	RCB-AH820-1	RD25S820ΩJ	R: FXD CAR 820Ω ±5% 1/4W
R88	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R89	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R90	RCB-AH51-1	RD25S51ΩJ	R: FXD CAR 51Ω ±5% 1/4W
R91 thru R95	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R96	RCB-AH270-1	RD25S270ΩJ	R: FXD CAR 270Ω ±5% 1/4W
R97 thru R102	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R103	RCB-AH100-1	RD25S100ΩJ	R: FXD CAR 100Ω ±5% 1/4W
R104	RCB-AH100K-1	RD25S100KΩJ	R: FXD CAR 100kΩ ±5% 1/4W
R105			Not assigned
R106	RCB-AH33-1	RD25S33ΩJ	R: FXD CAR 33Ω ±5% 1/4W
R107	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R108	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R109	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R110 thru R112	RCB-AH180-1	RD25S180ΩJ	R: FXD CAR 180Ω ±5% 1/4W
R113 thru R115	RCB-AH270-1	RD25S270ΩJ	R: FXD CAR 270Ω ±5% 1/4W
R116 thru R118	RCB-AH820-1	RD25S820ΩJ	R: FXD CAR 820Ω ±5% 1/4W
R119	RCB-AH560-1	RD25S560ΩJ	R: FXD CAR 560Ω ±5% 1/4W
R120	RCB-AH330-1	RD25S330ΩJ	R: FXD CAR 330Ω ±5% 1/4W
R121	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R122	RCB-AH470-1	RD25S470ΩJ	R: FXD CAR 470Ω ±5% 1/4W
R123	RCB-AH10K-1	RD25S10KΩJ	R: FXD CAR 10kΩ ±5% 1/4W
R124	DHB-000332-1	THP-007-3	R: 3dB PAD
C151	CCP-ADR01U50V-1	C52AF1H103Z	C: FXD CHIP 0.01μF +80, -20% 50V
C152	CSM-AGR47U50V-1	FD76AF1H474Z	C: FXD CER 0.47μF +80, -20% 50V
C153	CCP-AGR47U50V-1	C76AF1H474Z	C: FXD CHIP 0.47μF +80, -20% 50V
C154	CCP-AGR47U50V-1	C76AF1H474Z	C: FXD CHIP 0.47μF +80, -20% 50V
C155	CCP-ADR1U50V-1	C52AF1H104Z	C: FXD CHIP 0.1μF +80, -20% 50V
C156	CCP-ADR01U50V-1	C52AF1H103X	C: FXD CHIP 0.01μF +80, -20% 50V
C157	CSM-AGR47U50V-1	FD76AF1H474Z	C: FXD CER 0.47μF +80, -20% 50V
C158	CCP-AGR47U50V-1	C76AF1H474Z	C: FXD CHIP 0.47μF +80, -20% 50V
C159	CCP-AGR47U50V-1	C76AF1H474Z	C: FXD CHIP 0.47μF +80, -20% 50V
C160	CCP-ADR1U50V-1	C52AF1H104Z	C: FXD CHIP 0.1μF +80, -20% 50V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C161	CCP-ADR1U50V-1	C52AF1H104Z	C: FXD CHIP 0.1µF +80, -20% 50V
C162	CSM-AGR47U50V-1	FD76AF1H474Z	C: FXD CER 0.47µF +80, -20% 50V
C163	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C164	CEE-AB4700P50V-1	BLM1H472NA	C: FXD BL 4700pF 50V
C165	CTA-AB10U16V-1	221M1602-106M	C: FXD ELECT TANTAL 10µF ±20% 16V
C166	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10µF ±20% 35V
C167	CCP-ADR01U50V-1	C52AF1H103Z	C: FXD CHIP 0.01µF +80, -20% 50V
C168	CSM-AGR47U50V-1	FD76AF1H474Z	C: FXD CER 0.47µF +80, -20% 50V
C169	CCP-ADR1U50V-1	C52AF1H104Z	C: FXD CHIP 0.1µF +80, -20% 50V
C170	CCP-ADR1U50V-1	C52AF1H104Z	C: FXD CHIP 0.1µF +80, -20% 50V
C171	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10µF ±20% 35V
C172	CTA-AB10U16V-1	221M1602-106M	C: FXD ELECT TANTAL 10µF ±20% 16V
C173 thru C175	CCP-ADR1U50V-1	C52AF1H104Z	C: FXD CHIP 0.1µF +80, -20% 50V
C176	CMC-AB12PR5K-6	DM10C120K5	C: FXD DIPPED MICA 12pF ±10% 500V
C177	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C178	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C179			Not assigned
C180	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C181	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C182			Not assigned
C183			Not assigned
C184	CSM-AGR47U50V-1	FD76AF1H474Z	C: FXD CER 0.47µF +80, -20% 50V
C185	CCP-ADR1U50V-1	C52AF1H104Z	C: FXD CHIP 0.1µF +80, -20% 50V
C203	CTA-AB10U35V-1	221M3502-106M	C: FXD ELECT TANTAL 10µF ±20% 35V
C204	CTA-AB10U35V-1	222M3502-106M	C: FXD ELECT TANTAL 10µF ±20% 35V
C205	CTA-AB10U16V-1	222M1602-106M	C: FXD ELECT TANTAL 10µF ±20% 16V
C206	CTA-AA100U10V-1	111M1002-107M	C: FXD ELECT TANTAL 100µF ±20% 10V
C207 thru C211	CTA-AC1U50V-1	244M5002-105M	C: FXD ELECT TANTAL 1µF ±20% 50V
C212 thru C216	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01µF +80, -20% 50V
C217			Not assigned
C218			Not assigned
C219	CTA-AC10U16V-1	242M1602-106M	C: FXD ELECT TANTAL 10µF ±20% 16V
L221	LCL-A00027-1	*	L: FXD Coil
L222			Not assigned
L223	LCL-A00027-1	*	L: FXD Coil
L224			Not assigned
L225	LCL-B00376-1	TPF0410-331K	L: FXD Coil
L226	LCL-T00084-1	*	L: FXD Coil
	MBM-10372A-1	401-9630A	Terminal

TR4172
COUNTER SWITCH
BLB-010505

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
Q1 thru Q4	STN-2SC2026-1	2SC2026	Transistor SI NPN
D11 thru D13			Not assigned
D14 thru D31	SDS-1S2222-1	1S2222	Diode SI
R41			Not assigned
R42			Not assigned
R43			Not assigned
R44			Not assigned
R45			Not assigned
R46			Not assigned
R47			Not assigned
R48	RCB-AG270-1	RD12S270ΩJ	R: FXD CAR 270Ω ±5% 1/8W
R49	RCB-AG33-1	RD12S33ΩJ	R: FXD CAR 33Ω ±5% 1/8W
R50	RCB-AG270-1	RD12S270ΩJ	R: FXD CAR 270Ω ±5% 1/8W
R51	RCB-AG3R3K-1	RD12S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/8W
R52	RCB-AG5R6K-1	RD12S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/8W
R53	RCB-AG3R3K-1	RD12S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/8W
R54	RCB-AG2R2K-1	RD12S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/8W
R55	RCB-AG270-1	RD12S270ΩJ	R: FXD CAR 270Ω ±5% 1/8W
R56	RCB-AG33-1	RD12S33ΩJ	R: FXD CAR 33Ω ±5% 1/8W
R57	RCB-AG270-1	RD12S270Ω	R: FXD CAR 270Ω ±5% 1/8W
R58	RCB-AG3R3K-1	RD12S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/8W
R59	RCB-AG5R6K-1	RD12S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/8W
R60	RCB-AG3R3K-1	RD12S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/8W
R61	RCB-AG2R2K-1	RD12S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/8W
R62	RCB-AG270-1	RD12S270ΩJ	R: FXD CAR 270Ω ±5% 1/8W
R63	RCB-AG33-1	RD12S33ΩJ	R: FXD CAR 33Ω ±5% 1/8W
R64	RCB-AG270-1	RD12S270ΩJ	R: FXD CAR 270Ω ±5% 1/8W
R65	RCB-AG3R3K-1	RD12S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/8W
R66	RCB-AG5R6K-1	RD12S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/8W
R67	RCB-AG3R3K-1	RD12S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/8W
R68	RCB-AG2R2K-1	RD12S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/8W
R69	RCB-AG270-1	RD12S270ΩJ	R: FXD CAR 270Ω ±5% 1/8W
R70	RCB-AG33-1	RD12S33ΩJ	R: FXD CAR 33Ω ±5% 1/8W
R71	RCB-AG270-1	RD12S270ΩJ	R: FXD CAR 270Ω ±5% 1/8W
R72	RCB-AG3R3K-1	RD12S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/8W
R73	RCB-AG5R6K-1	RD12S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/8W
R74	RCB-AG3R3K-1	RD12S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/8W
R75	RCB-AG2R2K-1	RD12S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/8W
R76	RCB-AG270-1	RD12S270ΩJ	R: FXD CAR 270Ω ±5% 1/8W
R77	RCB-AG33-1	RD12S33ΩJ	R: FXD CAR 33Ω ±5% 1/8W
R78	RCB-AG270-1	RD12S270ΩJ	R: FXD CAR 270Ω ±5% 1/8W
R79	RCB-AG5R6K-1	RD12S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/8W
R80	RCB-AG3R3K-1	RD12S3.3KΩJ	R: FXDAR 3.3kΩ ±5% 1/8W
R81	RCB-AG2R2K-1	R•12S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/8W

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
R84	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R85	RCB-AG22-1	RD12S22ΩJ	R: FXD CAR 22Ω ±5% 1/8W
R86	RCB-AH330-1	RD25S330ΩJ	R: FXD CAR 330Ω ±5% 1/4W
R87	RCB-AG3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R88	RCB-AG5R6K-1	RD25S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/4W
R89	RCB-AG3R3K-1	RD25S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/4W
R90	RCB-AG2R2K-1	RD25S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/4W
R91	RCB-AG270-1	RD25S270ΩJ	R: FXD CAR 270Ω ±5% 1/4W
R92	RCB-AG33-1	RD25S33ΩJ	R: FXD CAR 33Ω ±5% 1/4W
R93	RCB-AG270-1	RD25S270ΩJ	R: FXD CAR 270Ω ±5% 1/4W
R94	RCB-AG5R6K-1	RD12S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/8W
R95	RCB-AG3R3K-1	RD12S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/8W
R96	RCB-AG2R2K-1	RD12S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/8W
R97	RCB-AG22-1	RD12S22ΩJ	R: FXD CAR 22Ω ±5% 1/8W
R98	RCB-AG22-1	RD12S22ΩJ	R: FXD CAR 22Ω ±5% 1/8W
R99	RCB-AG1K-1	RD12S1KΩJ	R: FXD CAR 1kΩ ±5% 1/8W
R100	RCB-AG22-1	RD12S22ΩJ	R: FXD CAR 22Ω ±5% 1/8W
R101	RCB-AH330-1	RD25S330ΩJ	R: FXD CAR 330Ω ±5% 1/4W
R102	RCB-AG3R3K-1	RD12S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/8W
R103	RCB-AG5R6K-1	RD12S5.6KΩJ	R: FXD CAR 5.6kΩ ±5% 1/8W
R104	RCB-AG3R3K-1	RD12S3.3KΩJ	R: FXD CAR 3.3kΩ ±5% 1/8W
R105	RCB-AG2R2K-1	RD12S2.2KΩJ	R: FXD CAR 2.2kΩ ±5% 1/8W
C111	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C112	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C113	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C114	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C115	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF+80, -20% 5-V
C116 thru C119	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C120	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C121	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C122	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C123	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C124	CSM-AC1000P50V-1	0.001UF50WV	C: FXD CER 0.001μF +80, -20% 50V
C125	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C126 thru C129	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C130 thru C132	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C133	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C134	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C135	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C136 thru C138	CSM-AC2200P50V-1	0.0022UF50WV	C: FXD CER 0.0022μF +80, -20% 50V
C139	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C140	CSM-AC2200P50V-1	0.0022UF50WV	C: FXD CER 0.022μF +80, -20% 50V

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
C141	CMC-AB10PR5K-4	DM10D100J5	C: FXD DIPPED MICA 10pF ±5% 500V
C142	CMC-AB12PR5K-6	DM10C120K5	C: FXD DIPPED MICA 12pF ±10% 500V
C143	CSM-AC2200P50V-1	0.0022UF50WV	C: FXD CER 0.0022μF +80, -20% 50V
C144	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C145	CSM-AC2200P50V-1	0.0022UF50WV	C: FXD CER 0.022μF +80, -20% 50V
C146 thru C151	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C152	CMC-AB10PR5K-4	DM10D100J5	C: FXD DIPPED MICA 10pF ±5% 500V
C153	CMC-AB82PR3K-4	DM10D820J3	C: FXD DIPPED MICA 82pF ±5% 300V
C154	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C155	CSM-ACR047U50V-1	0.047UF50WV	C: FXD CER 0.047μF +80, -20% 50V
C156 thru C158	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
C159	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10μF 25V
C160	CCK-AB10U25V-1	25VB10	C: FXD ELECT 10μF 25V
C161	CSM-ACR01U50V-1	0.01UF50WV	C: FXD CER 0.01μF +80, -20% 50V
L171	LCL-A00062-1	LS20	L: FXD Coil
L172	LCL-C00329-1	*	L: FXD Coil
L173	LCL-C00010-1	CSL0609-181K	L: FXD Coil

TR4172
3.9GHz L.P.F BLOCK
MEP-351

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
FL1	DNF-000601-1	ZFN5101-01R	Filter
J77	JCF-AA001JX20-2	50-645-4526-89	Coaxial Connector
J78	JCF-AA001JX20-2	50-645-4526-89	Coaxial Connector
J79			Not assigned
J80			Not assigned
	DHB-000605-1	*	Low pass filter

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Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
CBL1	DCB-FF0971X01-1	*	Cable
CBL2	DCB-FF0971X17-1	*	Cable
CBL3	DCB-FF0971X15-1	*	Cable
CBL4 thru CBL10			Not assigned
CBL11	DCB-FF0934X16-1	*	Cable
CBL12 thru CBL16		*	Not assigned
CBL17	DCB-FF0934X23-1	*	Cable
CBL18	DCB-FF0934X07-1	*	Cable
CBL19	DCB-FF0934X08-1	*	Cable
CBL20	DCB-FF0934X18-1	*	Cable
CBL21	DCB-FF0934X22-1	*	Cable
CBL22 thru CBL26		*	Not assigned
CBL27	DCB-FF0934X09-1	*	Cable
CBL28	DCB-FF0934X14-1	*	Cable
CBL29	DCB-FF0934X20-1	*	Cable
CBL30	DCB-FF0934X09-1	*	Cable
CBL31	DCB-FF0934X04-1	*	Cable
CBL32	DCB-FF0934X09-1	*	Cable
CBL33	DCB-FF0934X07-1	*	Cable
CBL34	DCB-FF0934X29-1	*	Cable
CBL35	DCB-FF0934X12-1	*	Cable
CBL36	DCB-FF0934X32-1	*	Cable
CBL37	DCB-FF0934X09-1	*	Cable
CBL38	DCB-FF0934X13-1	*	Cable
CBL39	DCB-FF0934X09-1	*	Cable
CBL40	DCB-FF0934X09-1	*	Cable
CBL41	DCB-FF0934X21-1	*	Cable
CBL42	DCB-FF0990X03-1	*	Cable
CBL43	DCB-FF0990X01-1	*	Cable
CBL44	DCB-FF0990X02-1	*	Cable
CBL45		*	Not assigned
CBL46		*	Not assigned
CBL47	DCB-FF0971X08-1	*	Cable
CBL48	DCB-FF0971X11-1	*	Cable
CBL49	DCB-FF0971X04-1	*	Cable
CBL50	DCB-FF0971X11-1	*	Cable
CBL51	DCB-FF0971X01-1	*	Cable
CBL52	DCB-FQ0973X02-1	*	Cable

Parts No.	ADVANTEST Stock No.	Mfr Stock No.	Description
CBL53	DCB-FF0971X02-1	*	Cable
CBL54	DCB-FF0971X08-1	*	Cable
CBL55		*	Not assigned
CBL56	DCB-FF0971X15-1	*	Cable
CBL57	DCB-FF0971X10-1	*	Cable
CBL58	DCB-FF0971X13-1	*	Cable
CBL59	DCB-FF0971X09-1	*	Cable
CBL60		*	Not assigned
CBL61	DCB-FF0971X08-1	*	Cable
CBL62	DCB-FF0971X08-1	*	Cable
CBL63	DCB-FF0971X11-1	*	Cable
CBL64	DCB-FF0971X04-1	*	Cable
CBL65	DCB-FF0971X04-1	*	Cable
CBL66	DCB-FF0971X04-1	*	Cable
CBL67	DCB-FF0971X01-1	*	Cable
CBL68	DCB-FF0971X09-1	*	Cable
CBL69	DCB-FF0971X10-1	*	Cable
CBL70		*	Not assigned
CBL71	DCB-FF0971X13-1	*	Cable
CBL72	DCB-FF0971X13-1	*	Cable
CBL73		*	Not assigned
CBL74	DCB-FF0985X06-1	*	Cable
CBL75 thru CBL86		*	Not assigned
CBL87	DCB-FF0971X09-1	*	Cable
CBL88	DCB-FF0971X13-1	*	Cable
CBL89 thru CBL92			Not assigned
CBL93	DCB-FF0934X29-1	*	Cable
CBL94	DCB-FF0934X10-1	*	Cable

CIRCUIT DIAGRAMS

TABLE OF CONTENTS

40	RF KEY	BLN-010222
41	SUB-PANEL BLOCK	MEP-340
42	ATTENUATOR DRIVER BLOCK	BLC-010223
43	PREAMPLIFIER	BLB-010233
44	YIG OSCILLATOR BLOCK	MEP-341
45	YIG OSCILLATOR DRIVER	BLC-010224
46	STANDARD BLOCK	MEP-342
47	TIME BASE	BLB-010134
48	50 MHz STANDARD	BLB-010135
49	Not assigned	
50	1st MIXER BLOCK	MEP-343
51	1st MIXER	BTB-010136
52	RF BLOCK	MEP-345
53	RF	BLJ-010133
54	TRACKING GENERATOR BLOCK	MEP-346
55	TRACKING GENERATOR-1	BTF-010128
56	TRACKING GENERATOR-2	BLJ-010129
57	TRACKING GENERATOR-3	BTB-010130
58	3rd LOCAL BLOCK	MEP-347
59	153 MHz MIXER	BLC-010099
60	39 MHz MIXER	BLC-010100
61	23 MHz VCO	BLC-010101
62	2 MHz VCO	BLC-010102
63	3rd LOCAL PLL	BLC-010103
64	1st LOCAL PLL BLOCK	MEP-348
65	ISOLATION AMPLIFIER	BTB-010113x01/02
66	2 - 4 GHz PULSE GENERATOR	BTB-010114
67	100/101 MHz OSCILLATOR	BLC-010115
68	1st LOCAL MIXER	BLB-010116
69	ANALOG PHASE DETECTOR	BLB-010117
70	DIGITAL PHASE DETECTOR	BLB-010118
71	PLL FILTER	BLB-010119
72	100/101 MHz OSC. PLL	BLB-010120
73	COUNTER BLOCK	MEP-349
74	COUNTER	BLJ-010131
75	COUNTER SWITCH	BLB-010505
76	3.9 GHz L.P.F. BLOCK	MEP-351

77	OPTION MEMORY	BGC-010481
78	COUNTER SW BLOCK	MEP-349/400
79	RF-1	BLB-011297
80	RF-2	BLB-011298
81	RF-3	BLB-011299
82	RF-4	BLC-011300
83	RF-5	BLF-011301

PARTS ALLOCATIONS

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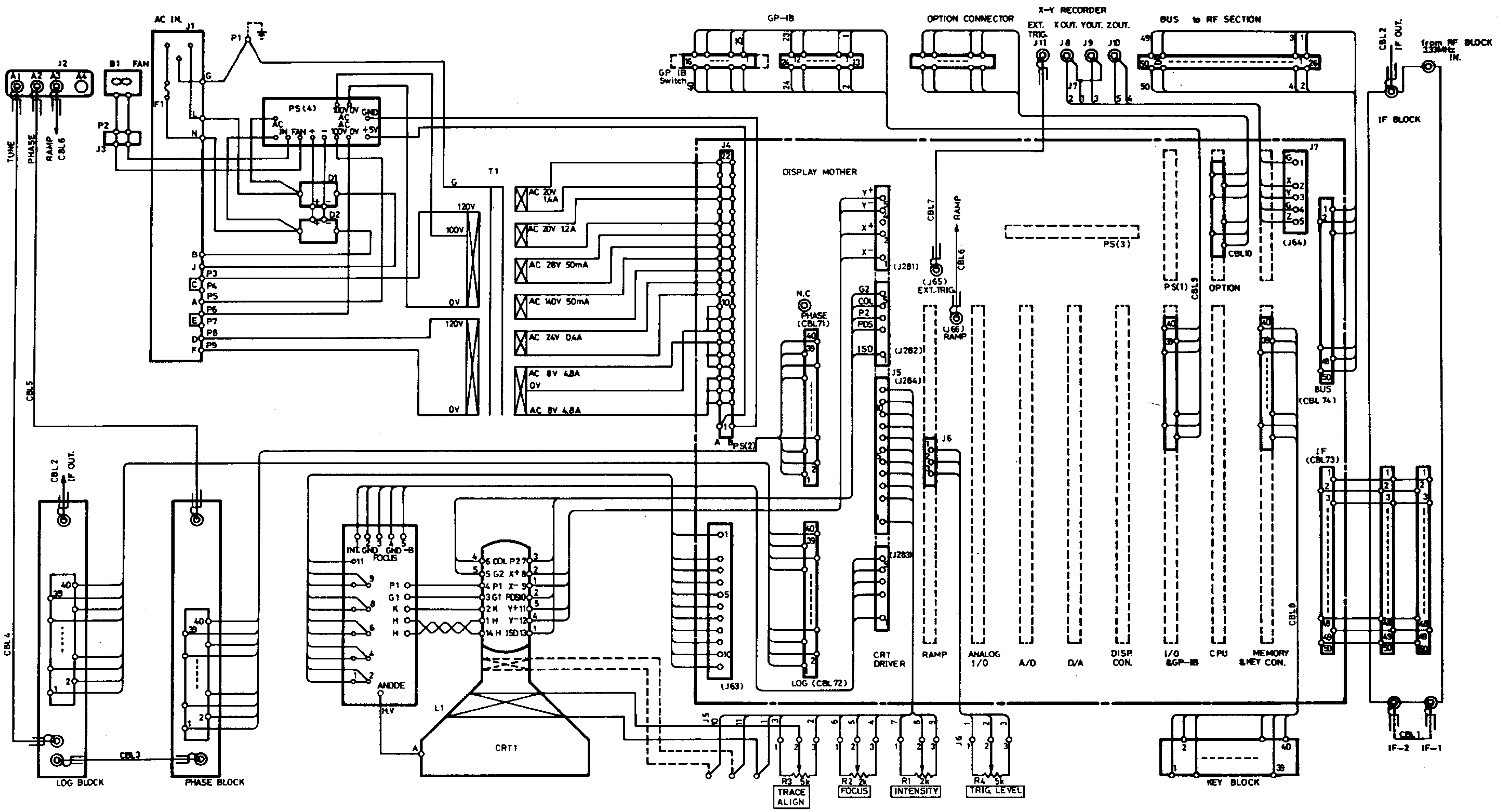
31	3rd LOCAL I/O	BGN-010221
32	RF KEY	BLN-010222
	SUB-PANEL BLOCK	MEP-340
33	ATTENUATOR DRIVER BLOCK	BLB-010223
34	PREAMPLIFIER	BLB-010233
	YIG OSCILLATOR BLOCK	MEP-341
35	YIG OSCILLATOR DRIVER	BLC-010224
	STANDARD BLOCK	MEP-342
36	TIME BASE	BLB-010134
37	50 MHz STANDARD	BLB-010135
38	50 MHz STANDARD SWITCH	BLB-010371
	1st MIXER BLOCK	MEP-343
39	1st MIXER	BTB-010136
	RF BLOCK	MEP-345
40	RF	BLJ-010133
	TRACKING GENERATOR BLOCK	MEP-346
41	TRACKING GENERATOR-1	BTF-010128
41	TRACKING GENERATOR-3	BTB-010130
42	TRACKING GENERATOR-2	BLJ-010129
	3rd LOCAL BLOCK	MEP-347
43	3rd LOCAL PLL	BLC-010103
44	153 MHz MIXER	BLC-010099
44	39 MHz MIXER	BLC-010100
44	23 MHz VCO	BLC-010101
44	2 MHz VCO	BLC-010102
	1st LOCAL PLL BLOCK	MEP-348
45	ISOLATION AMPLIFIER	BTB-010113x01
45	2 - 4 GHz PULSE GENERATOR	BTB-010114
45	100/101 MHz OSCILLATOR	BLC-010115
45	1st LOCAL MIXER	BLB-010116
45	ANALOG PHASE DETECTOR	BLB-010117
45	DIGITAL PHASE DETECTOR	BLB-010118
45	PLL FILTER	BLB-010119
45	100/101 MHz OSC. PLL	BLB-010120
	COUNTER BLOCK	MEP-349
46	COUNTER	BLJ-010131
47	COUNTER SWITCH	BLB-010505



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TR4172

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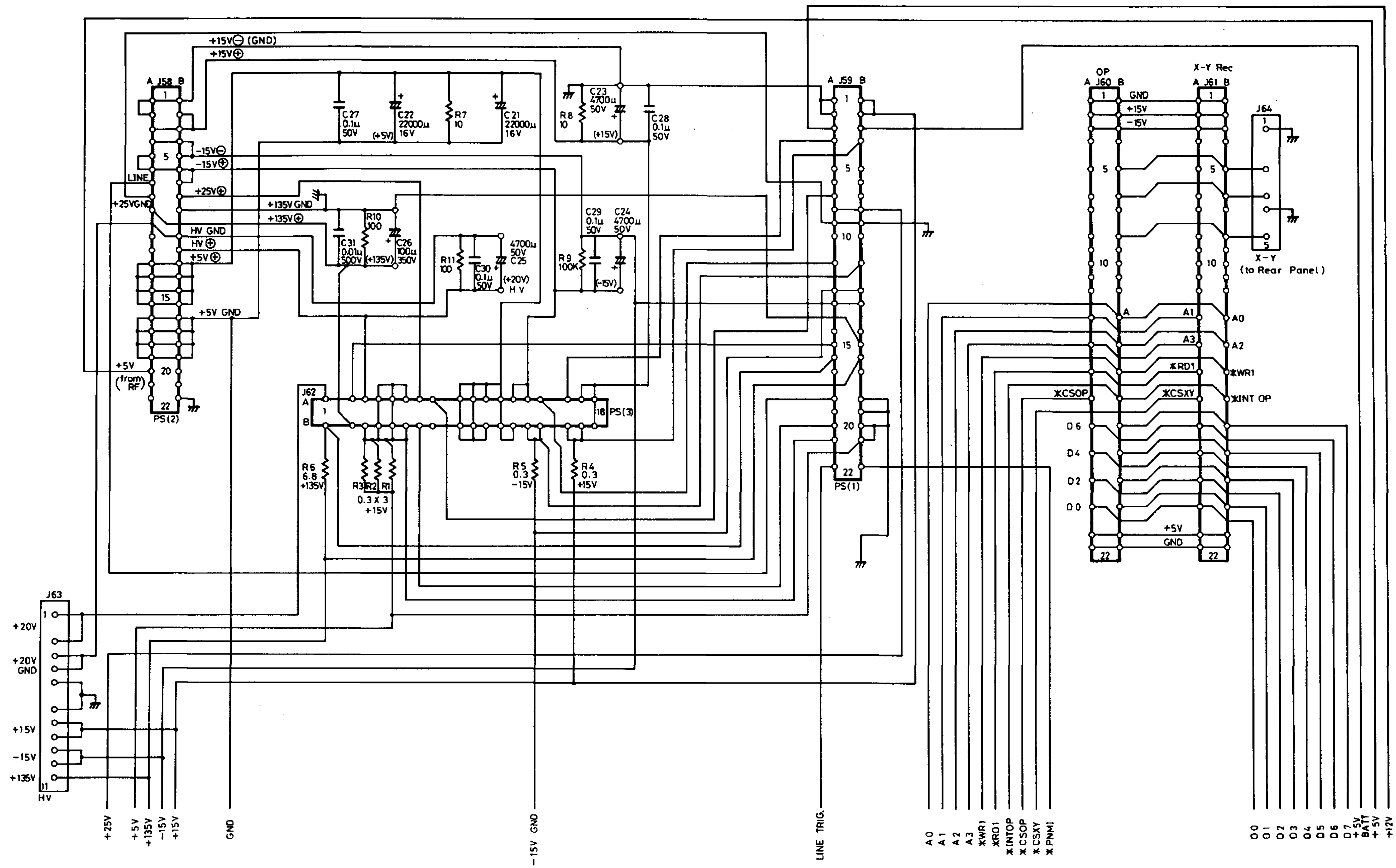
TR4172-DE



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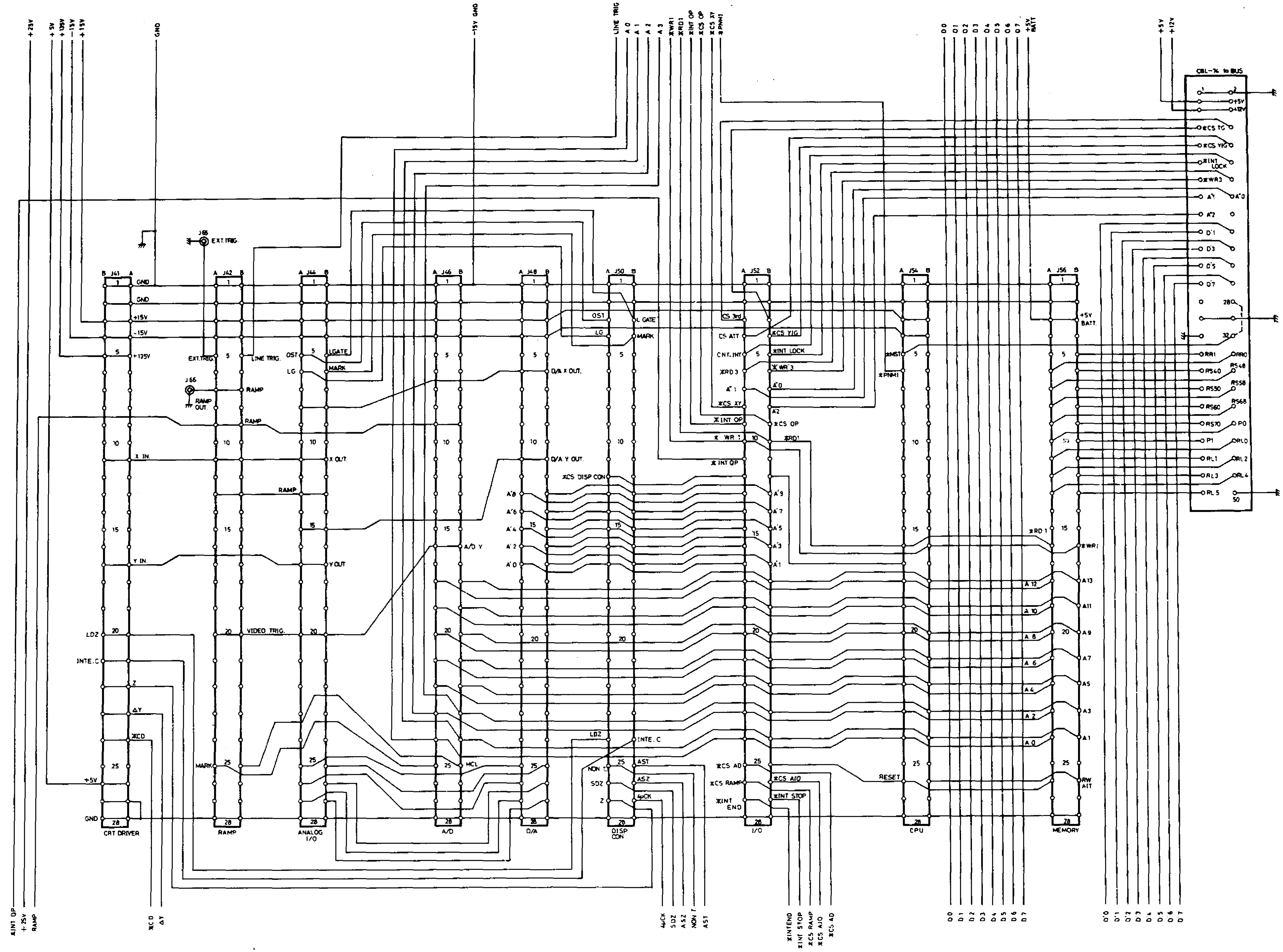
TR4172/4173/4173E

⟨2⟩ DISPLAY MOTHER

BLQ-010203 1/3



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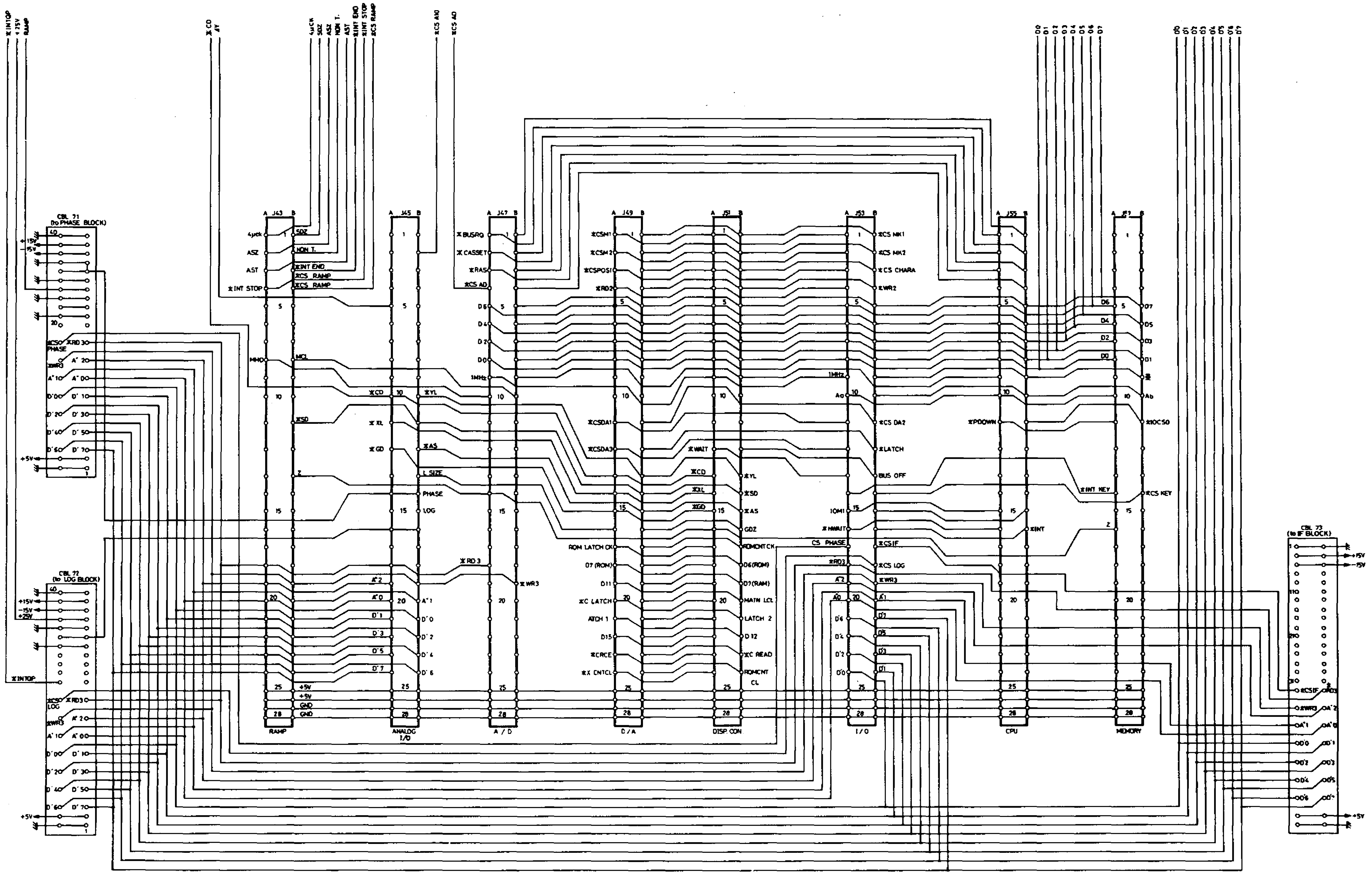
TR4172/4173/4173E
3 DISPLAY MOTHER
BLQ-010203 2/3



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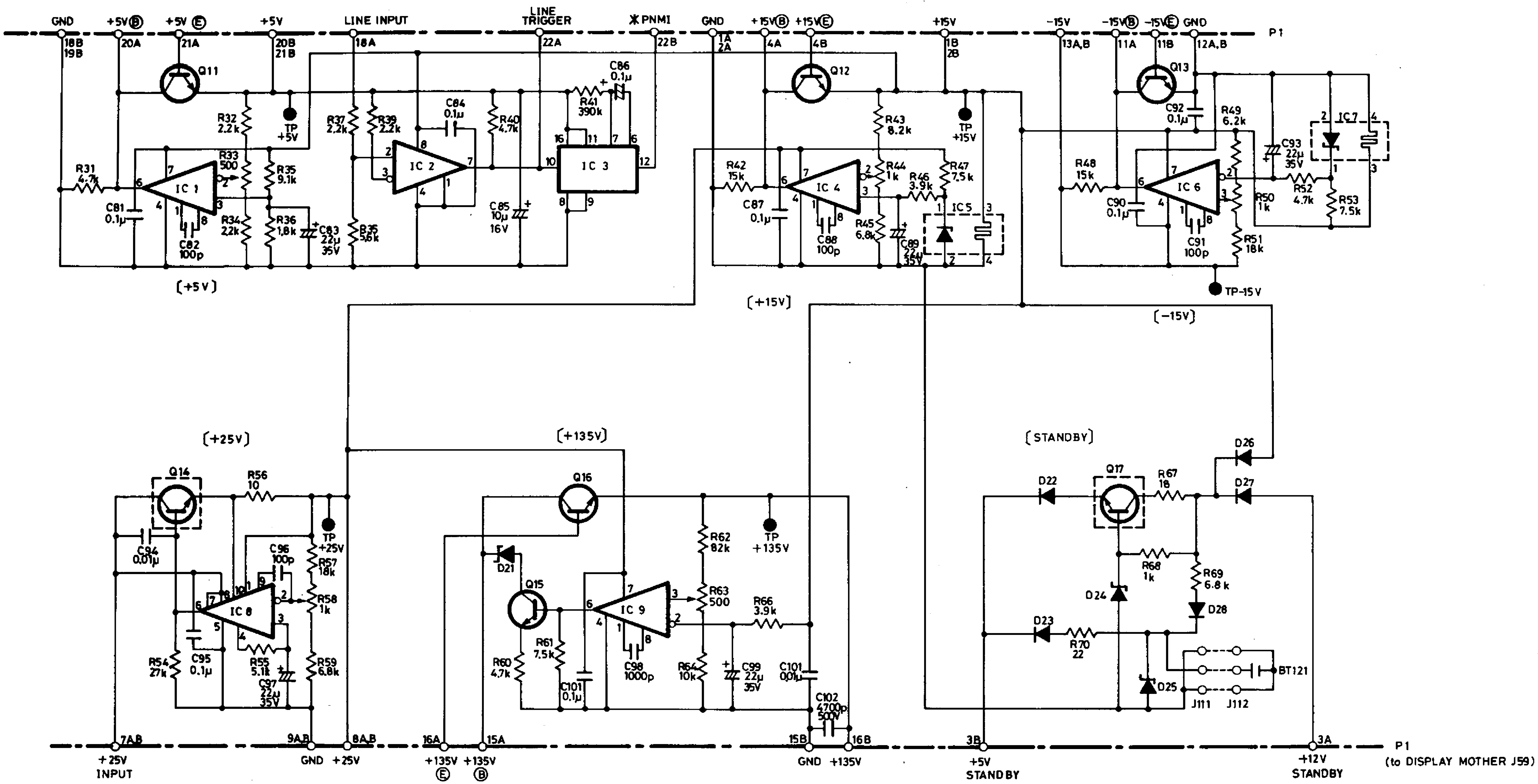
TR4172/4173/4173E
4 DISPLAY MOTHER
BLQ-010203 3/3



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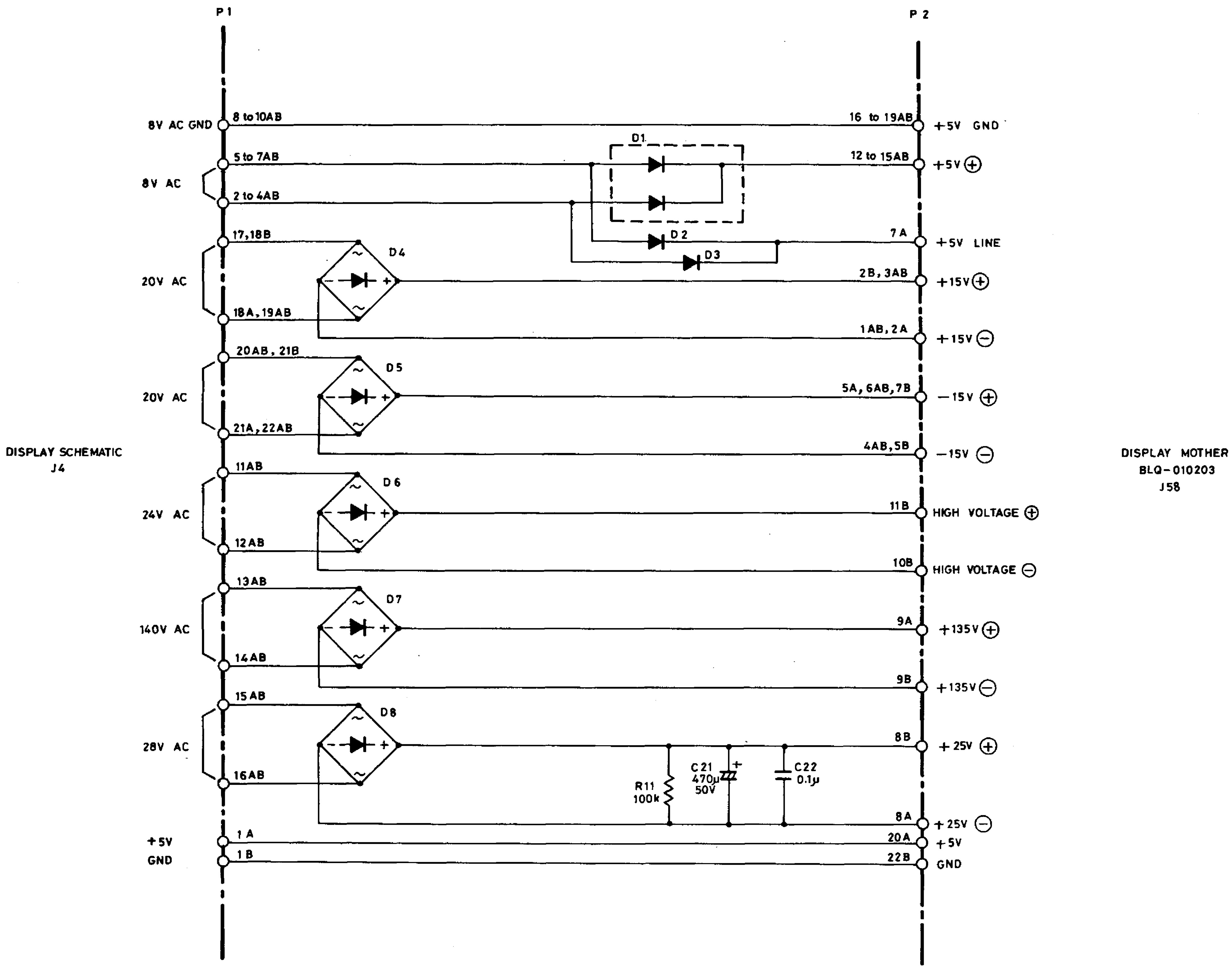
BGC−010198

0069301 − 005 − B



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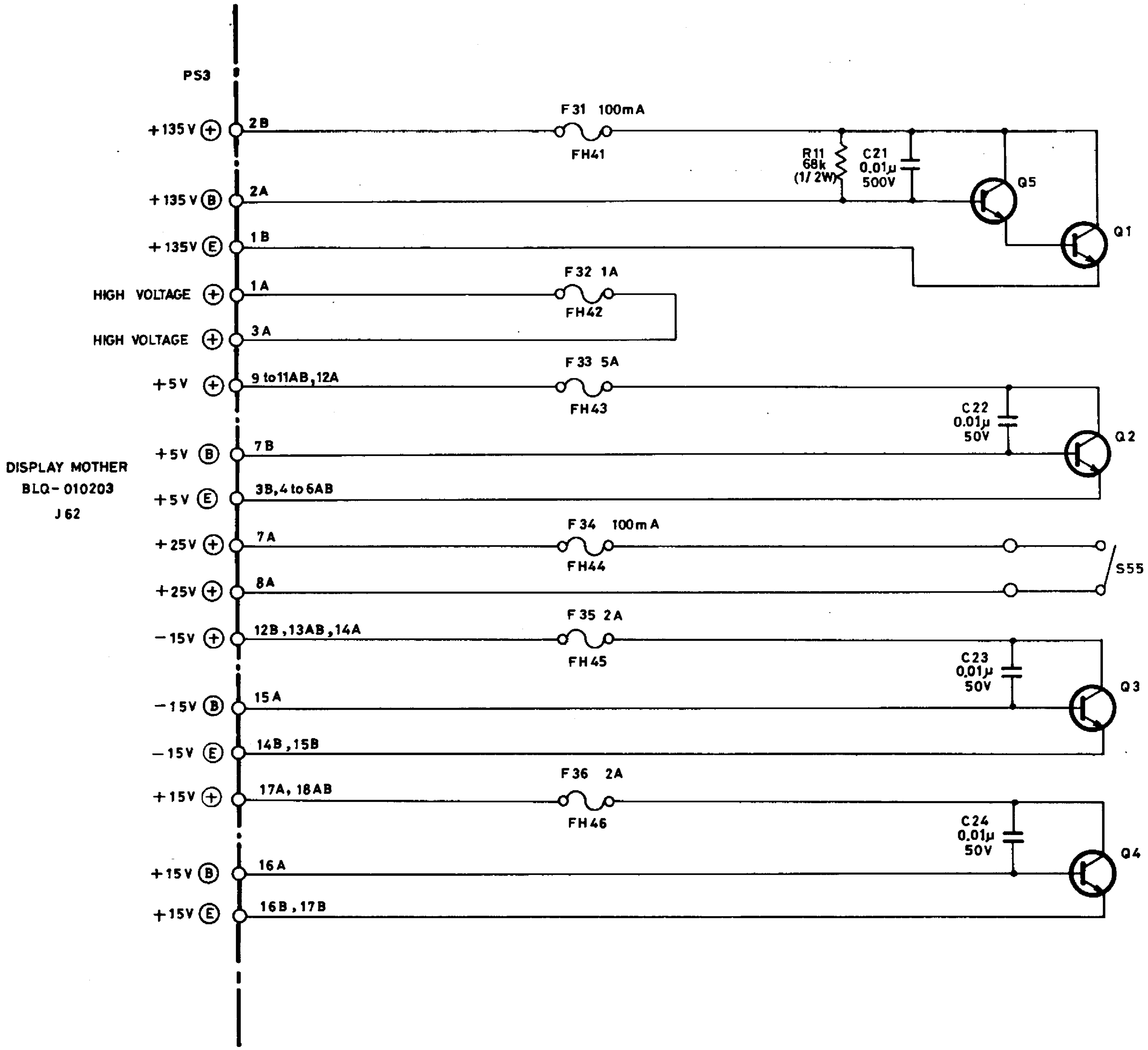
6 TR4172/4173/4173E
DISPLAY POWER 2
BGB−010199



0069301 — 007— B

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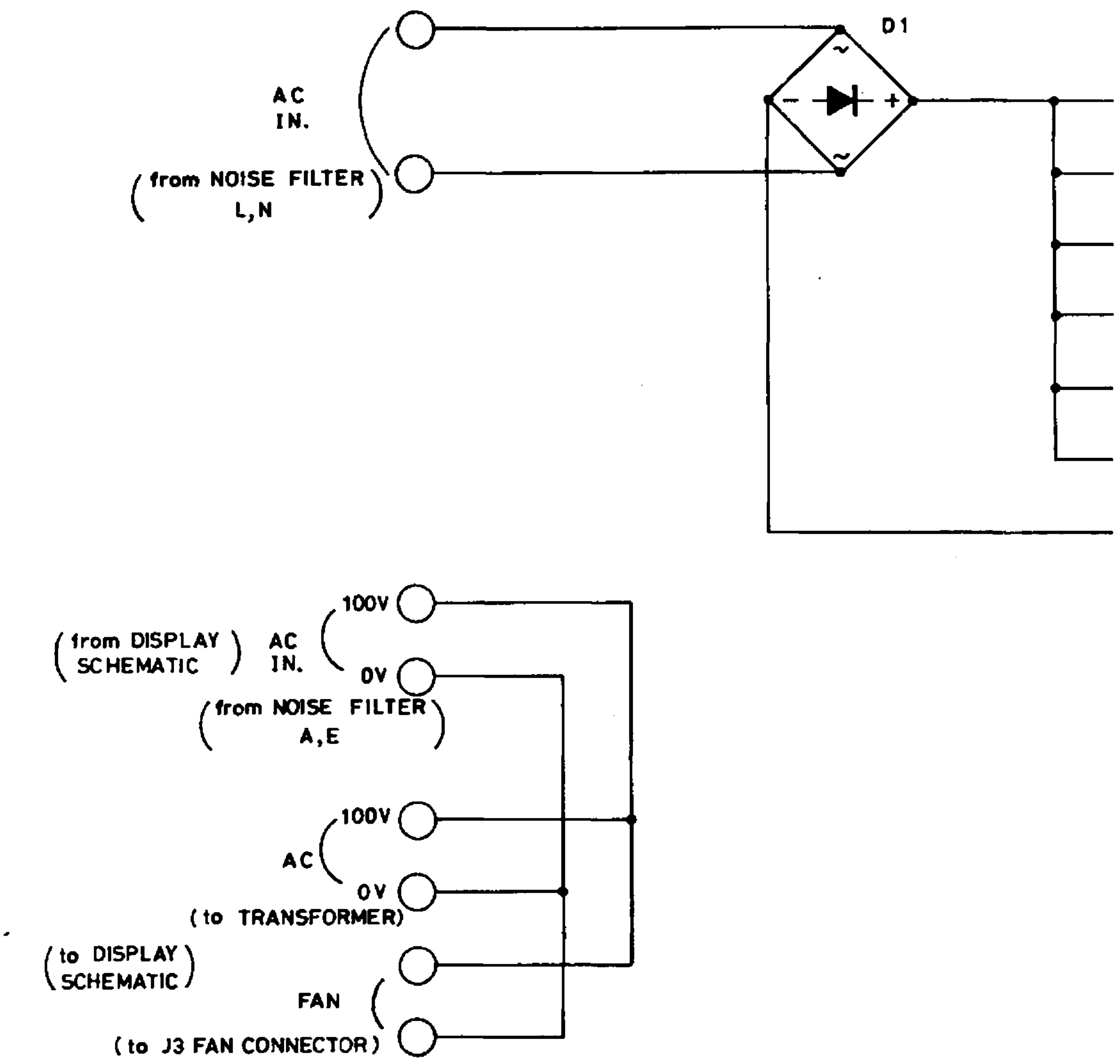
TR4172/4173/4173E
DISPLAY POWER 3
BGC–010369



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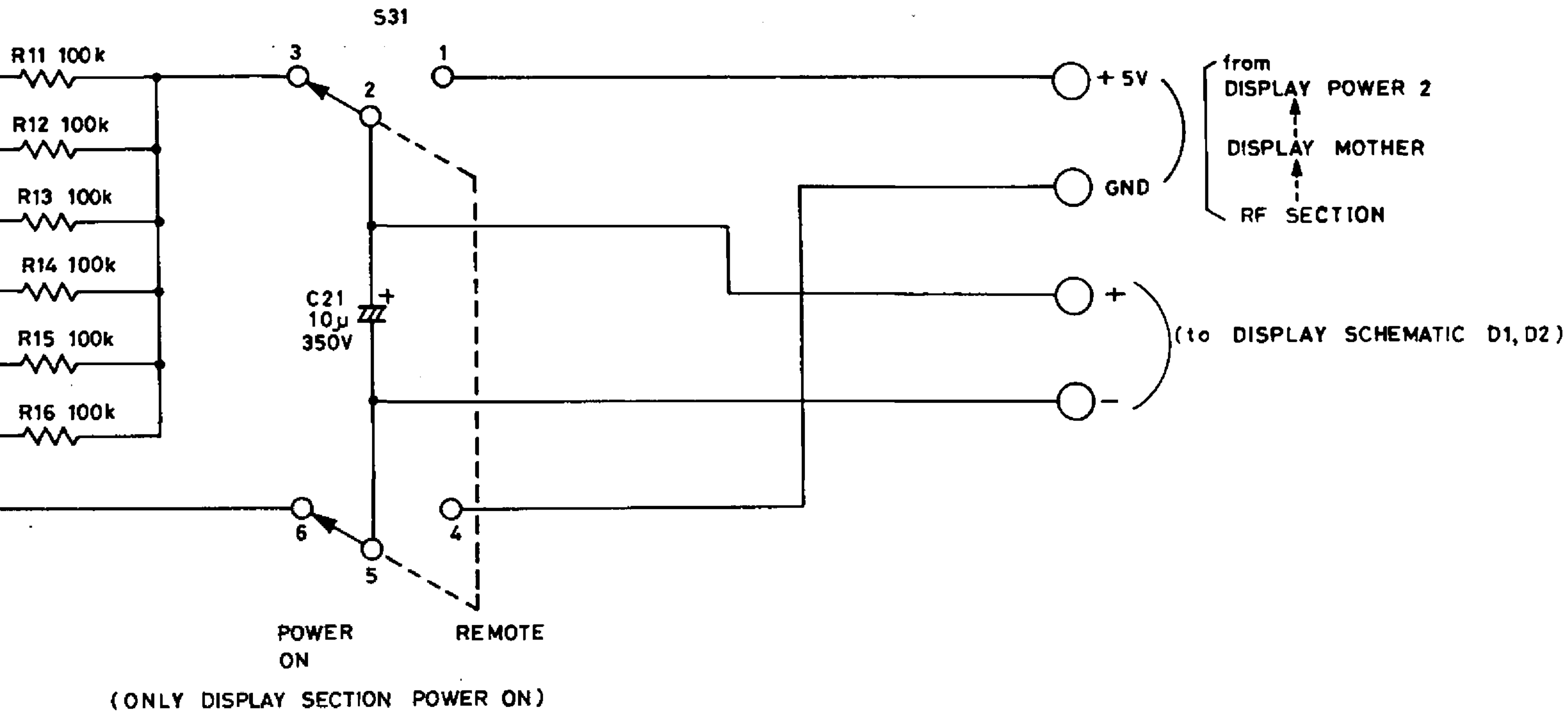
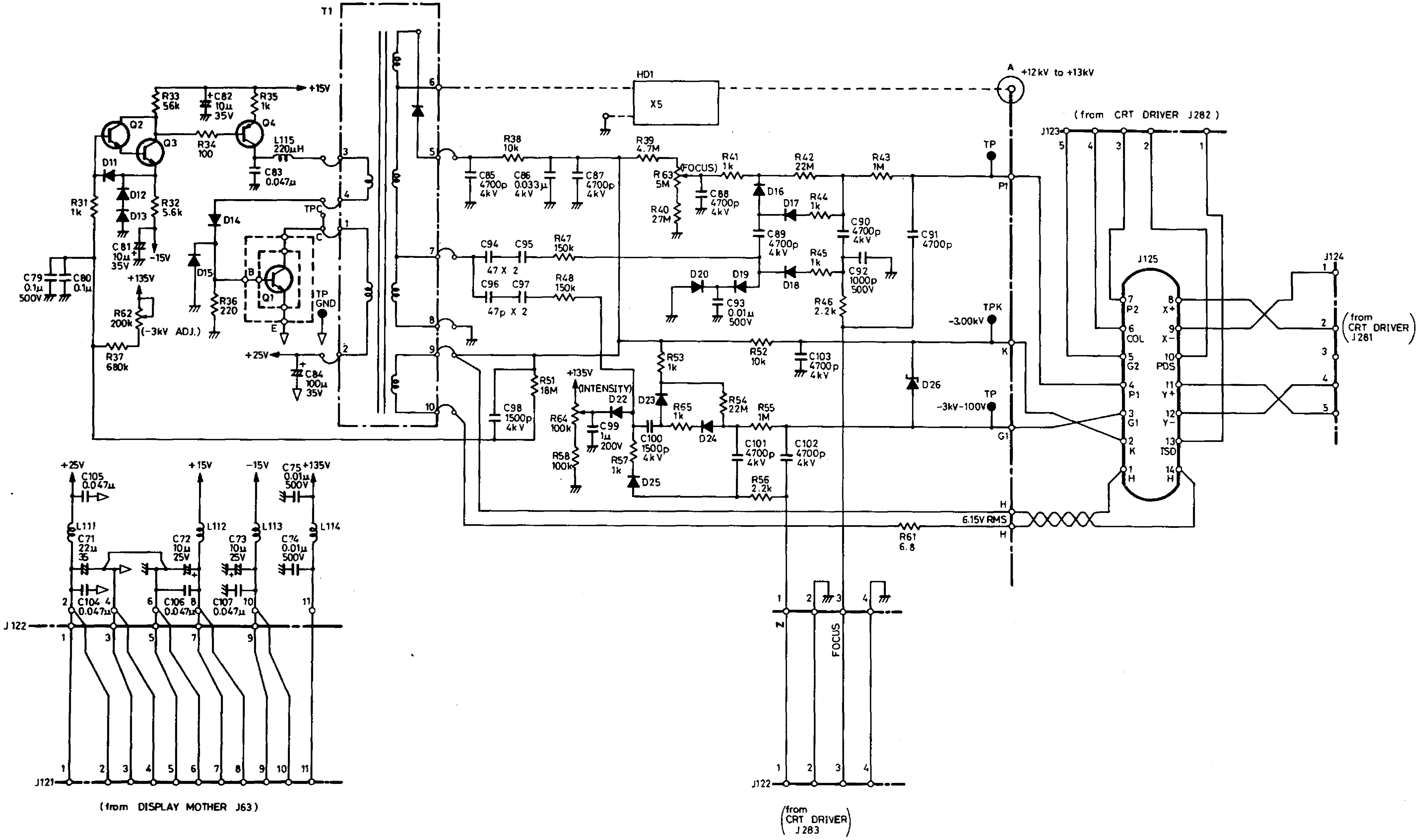


8

TR4172/4173/4173E
DISPLAY POWER 4
BLB−010202



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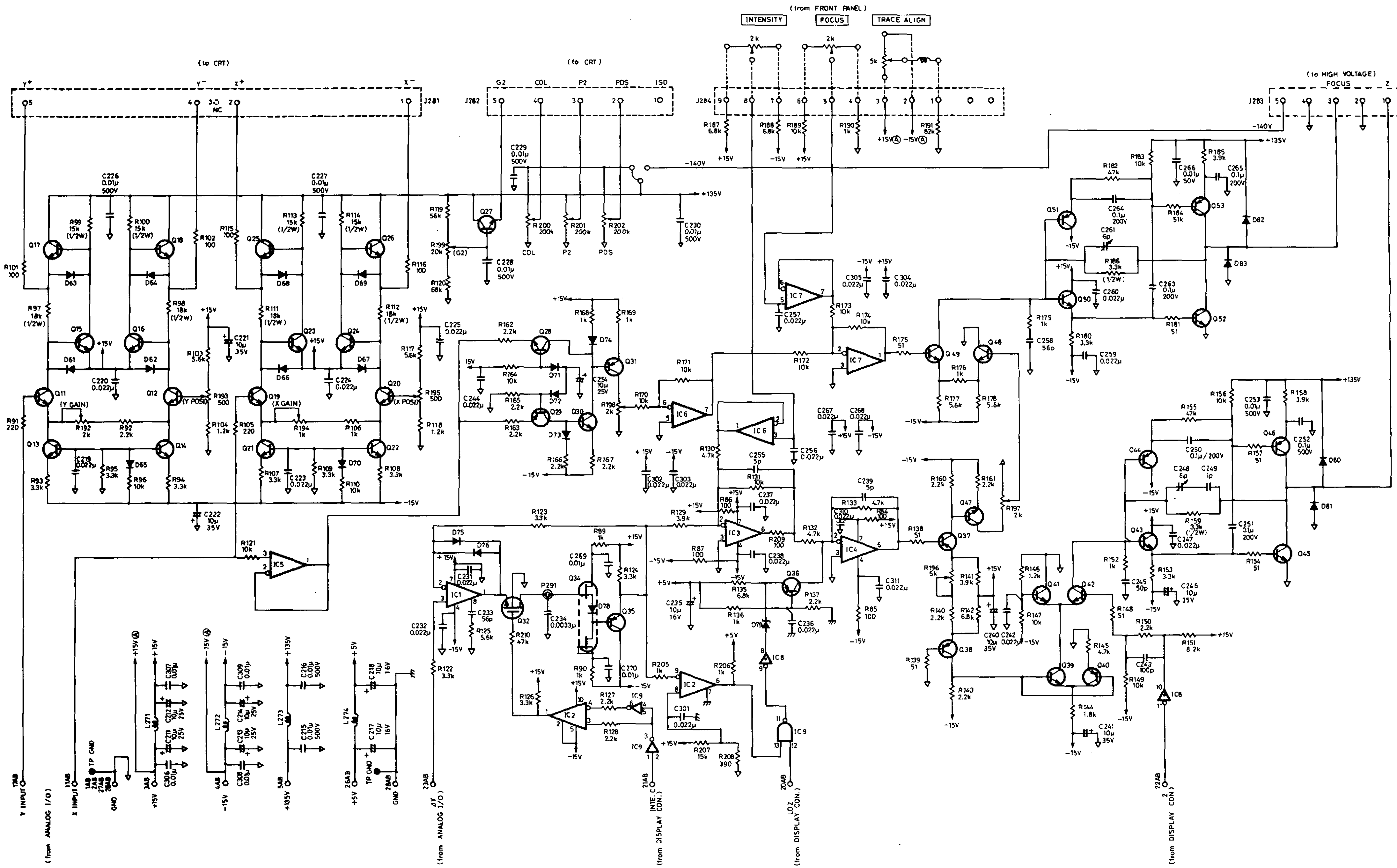
TR4172/4173/4173E

9 HIGH VOLTAGE

BLC-010204

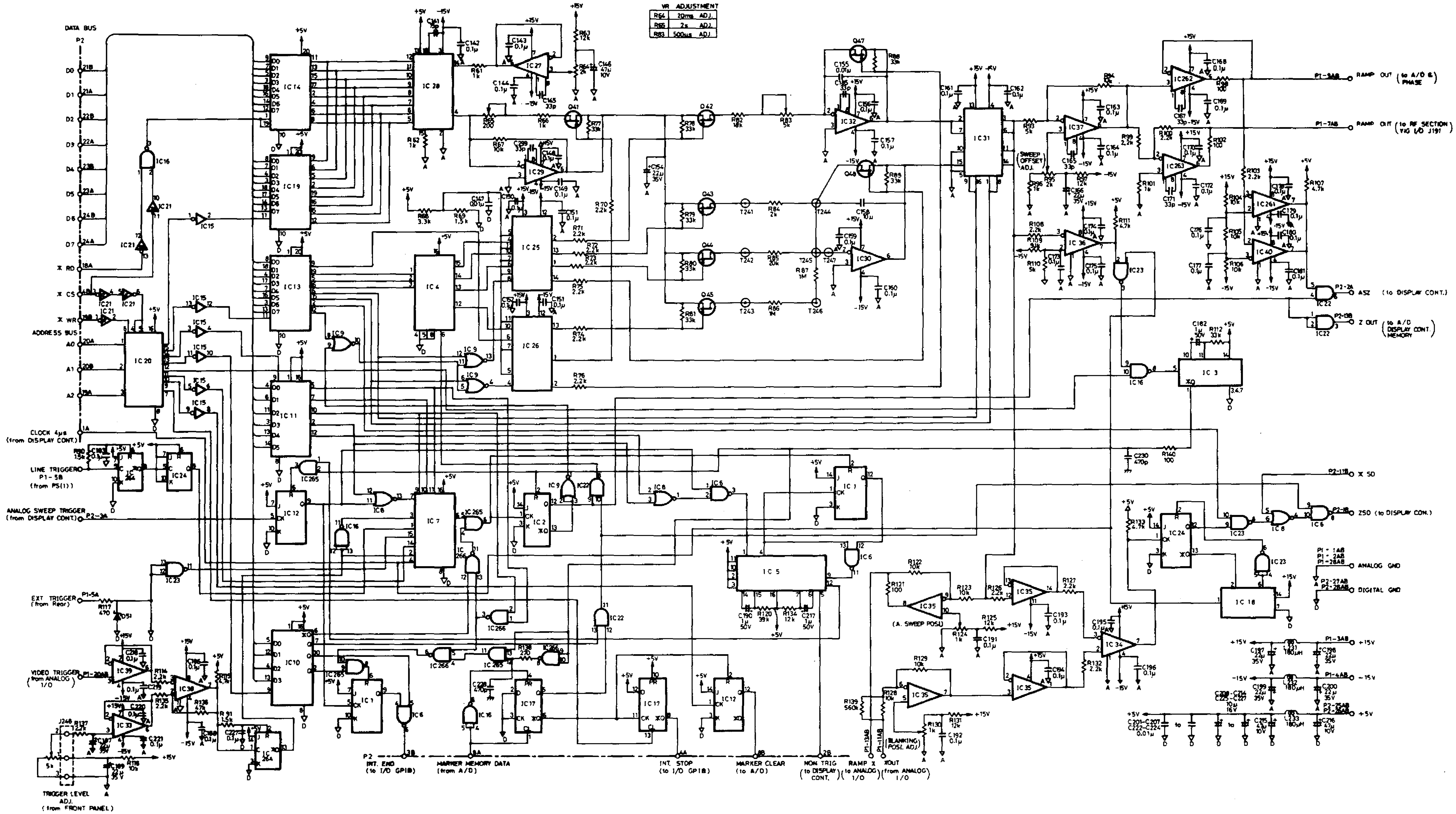


0069405 - 010 - D

TR4172/4173/4173E

⟨10⟩ **CRT DRIVER**

BGK-010184



0069412 - 011 - E

TR4172
11 RAMP GENERATOR
BGP-010185

LOG. MAG. ADJUSTMENT

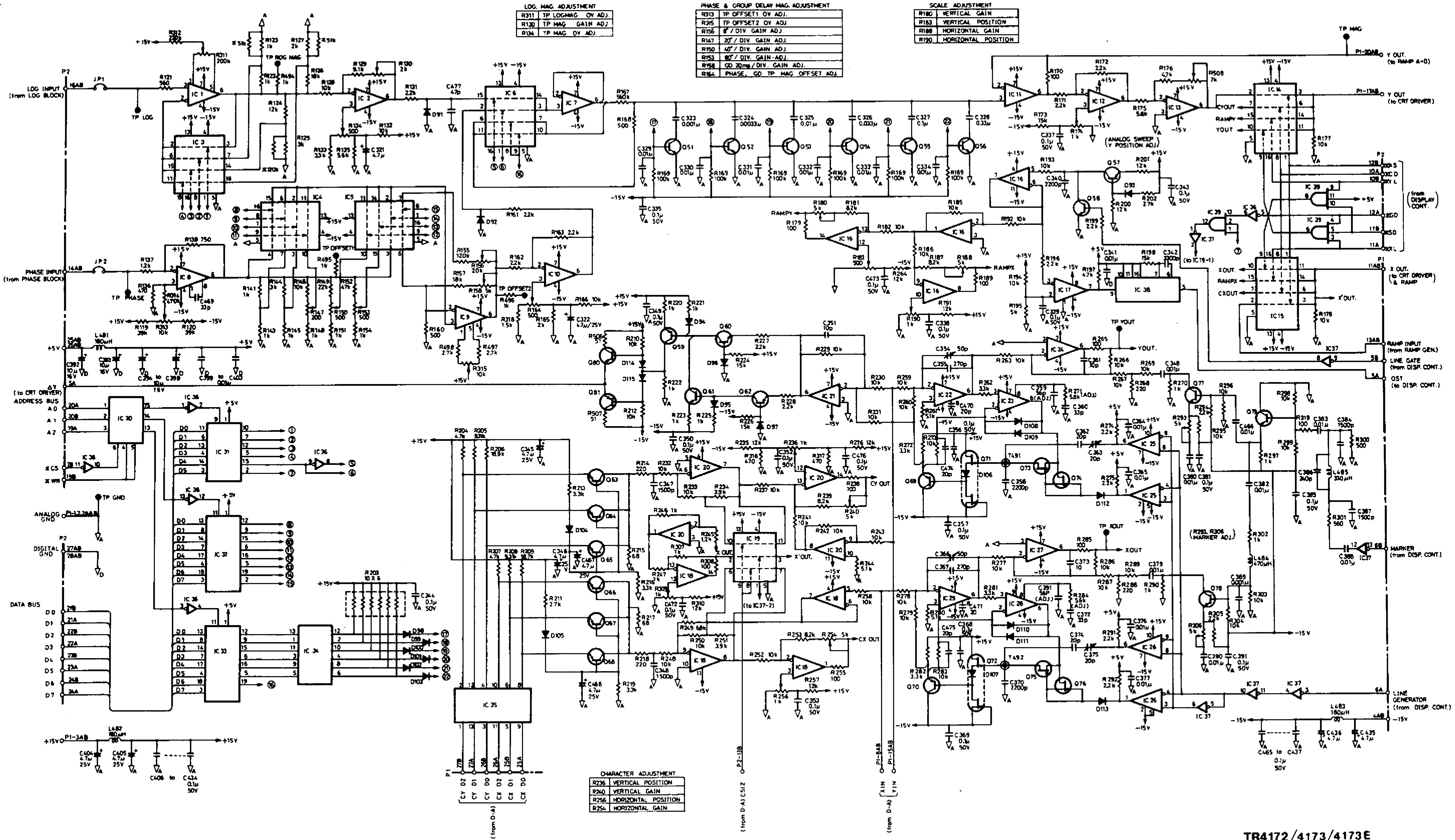
R311	TP LOGMAG 0V ADJ.
R130	TP MAG GAIN ADJ.
R134	TP MAG 0V ADJ.

PHASE & GROUP DELAY MAG. ADJUSTMENT

R313	TP OFFSET1 0V ADJ.
R315	TP OFFSET2 0V ADJ.
R156	8°/DIV. GAIN ADJ.
R147	20°/DIV. GAIN ADJ.
R150	40°/DIV. GAIN ADJ.
R153	80°/DIV. GAIN ADJ.
R158	GD 20ms/DIV. GAIN ADJ.
R164	PHASE, GD TP MAG OFFSET ADJ.

SCALE ADJUSTMENT

R180	VERTICAL GAIN
R183	VERTICAL POSITION
R188	HORIZONTAL GAIN
R190	HORIZONTAL POSITION



CHARACTER ADJUSTMENT

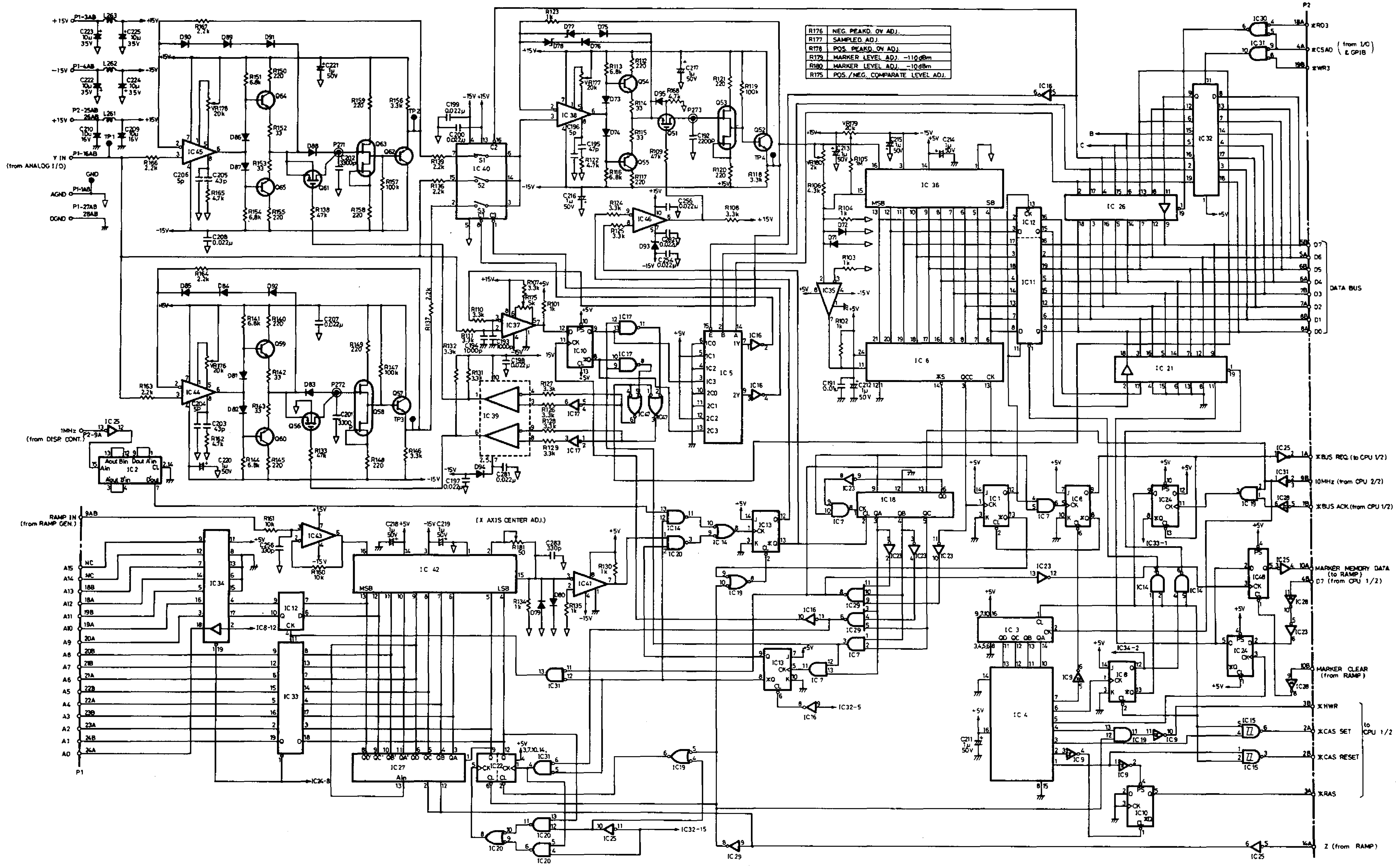
R236	VERTICAL POSITION
R240	VERTICAL GAIN
R256	HORIZONTAL POSITION
R254	HORIZONTAL GAIN

0069311 -012-D

TR4172/4173/4173E

12 ANALOG I/O

BGP-010186

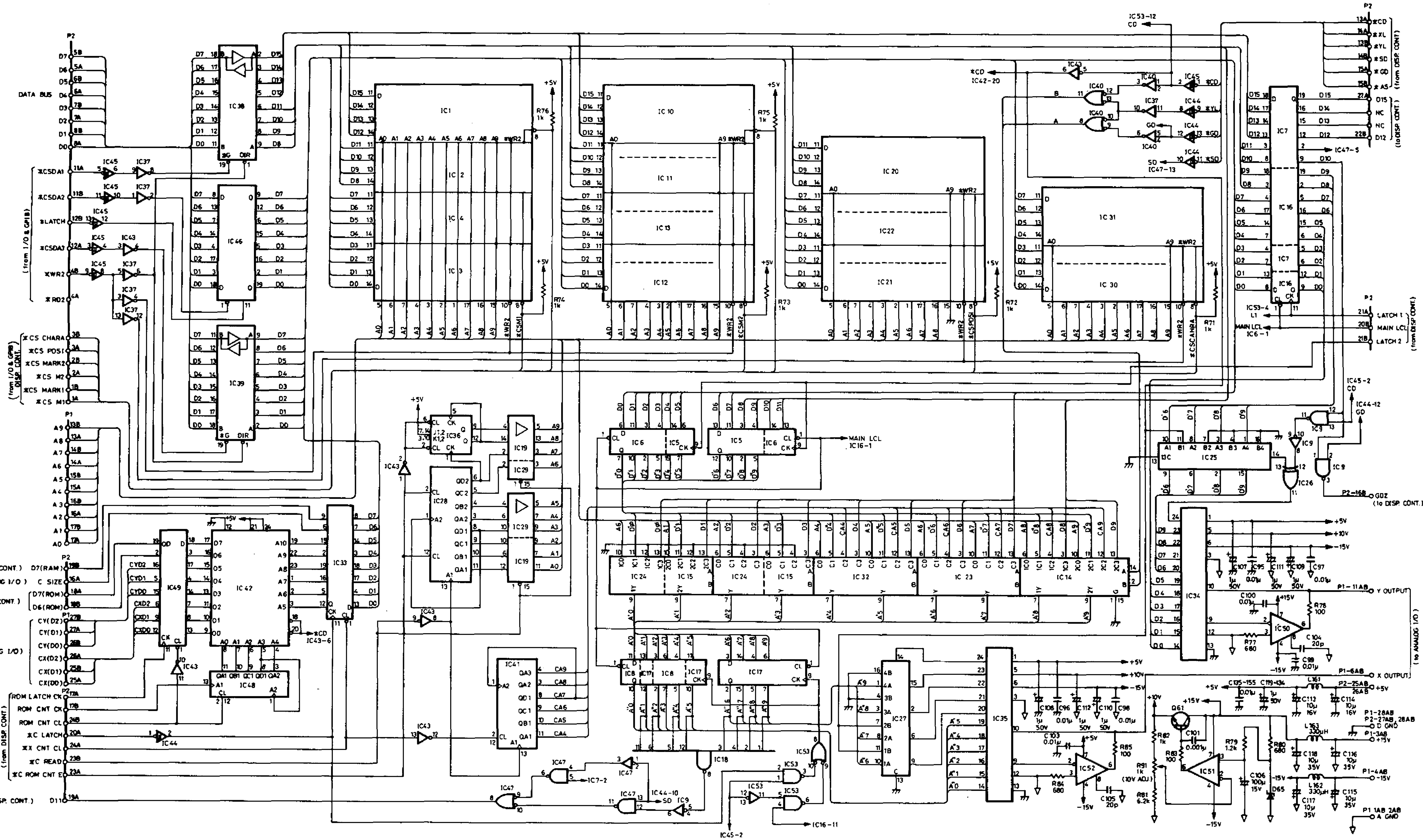


0069401-013-E

TR4172/4173/4173E

13 A-D CONVERTER

BGP-010187

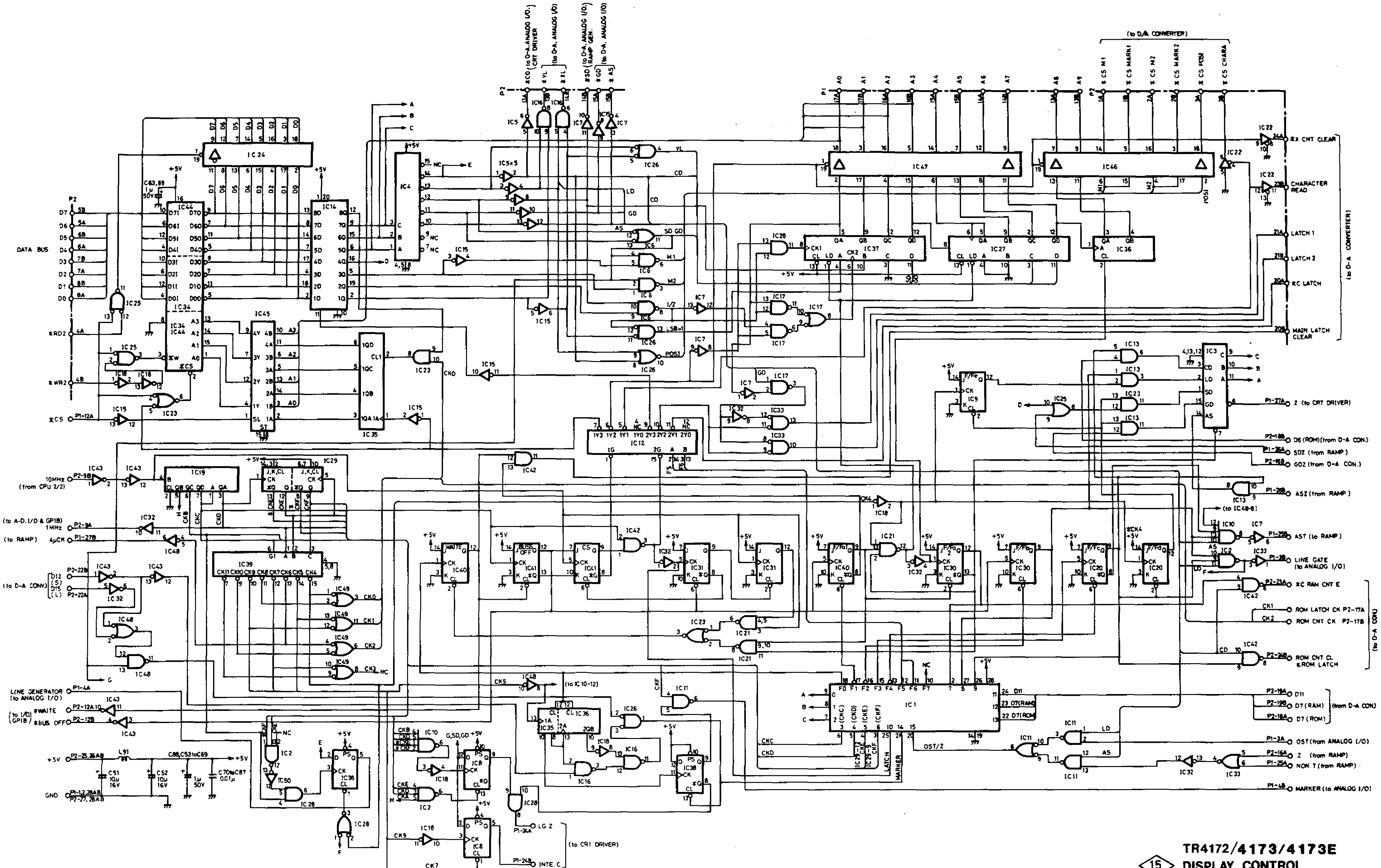


0069305-014-C

TR4172/4173/4173E

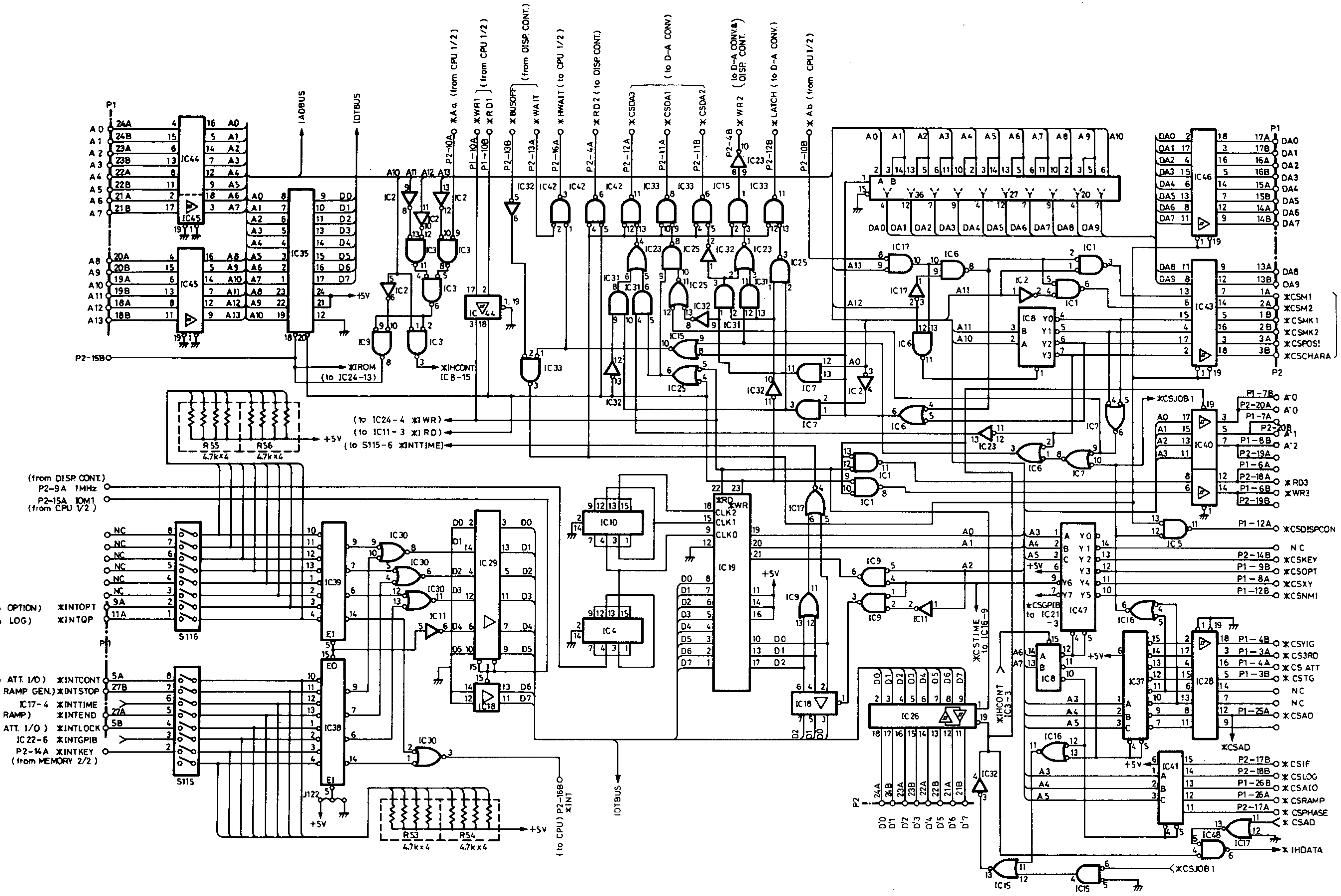
⟨14⟩ D-A CONVERTER

BGP-010188



TR4172/4173/4173E
15 DISPLAY CONTROL
BGP-010189

0069310-015-B

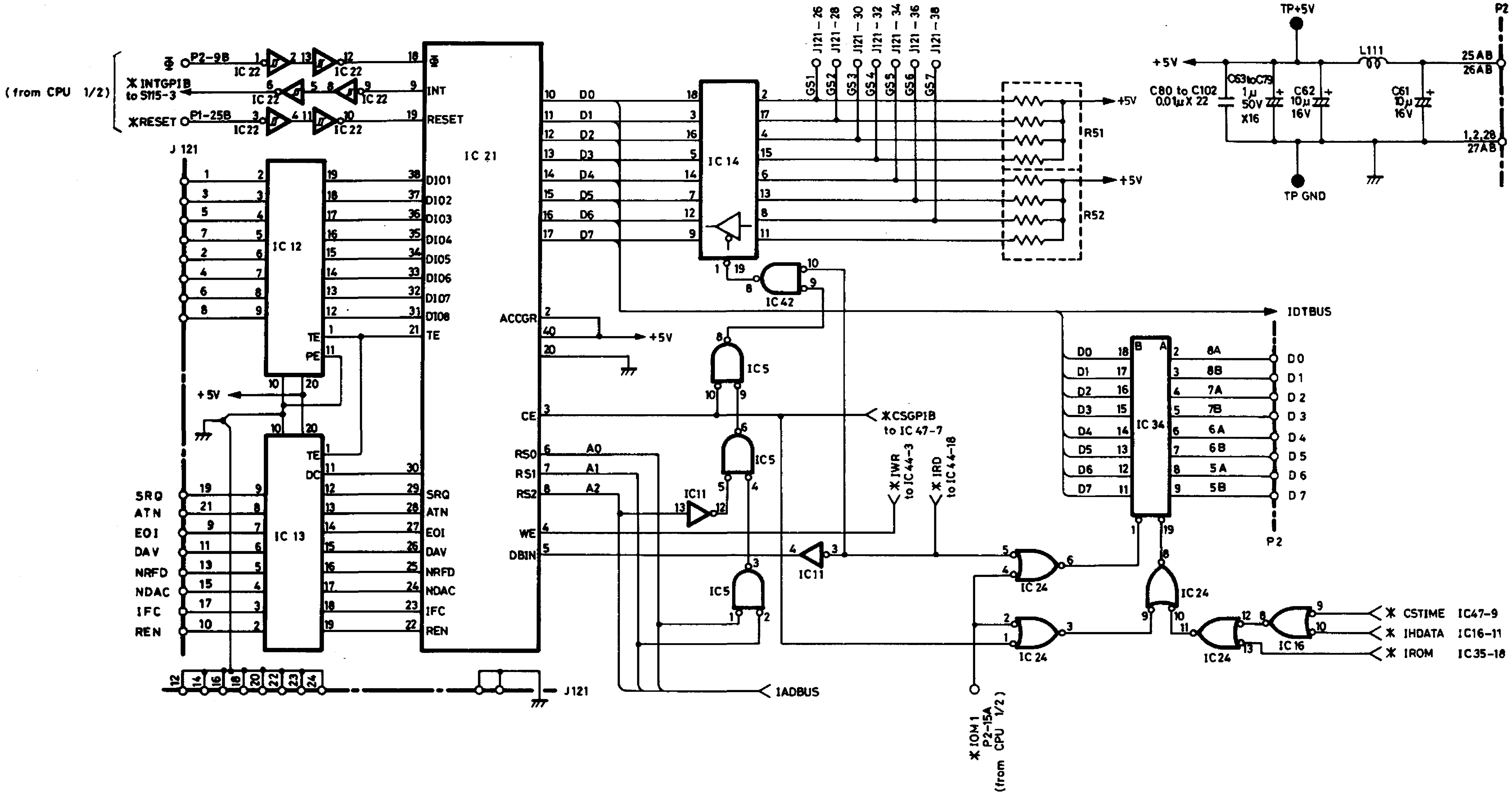


0069408 -016-C

TR4172/4173/4173E

⟨16⟩ I/O & GP-IB

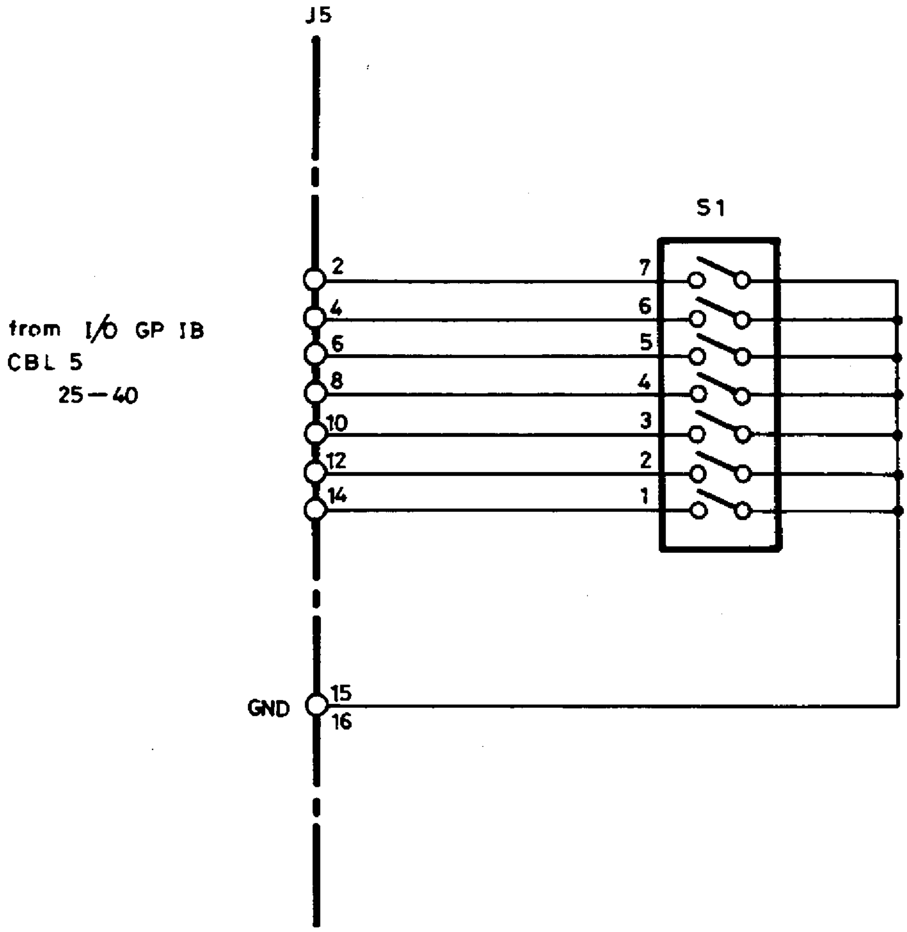
BGP-010190 1/2



0069301 — 017 — B

17

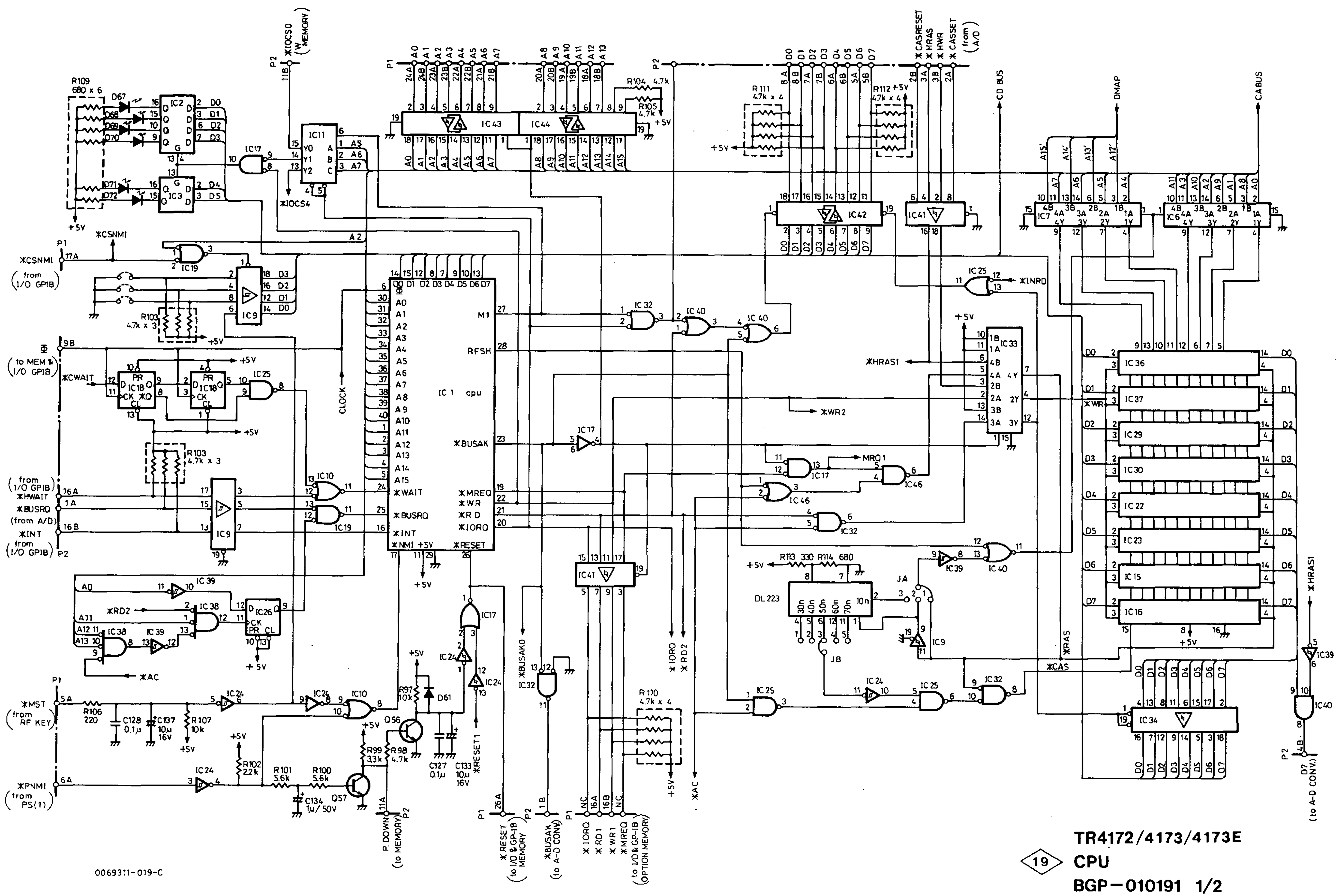
TR4172/4173/4173E
I/O & GP-IB
BGP-010190 2/2



0069209 —018— A

18

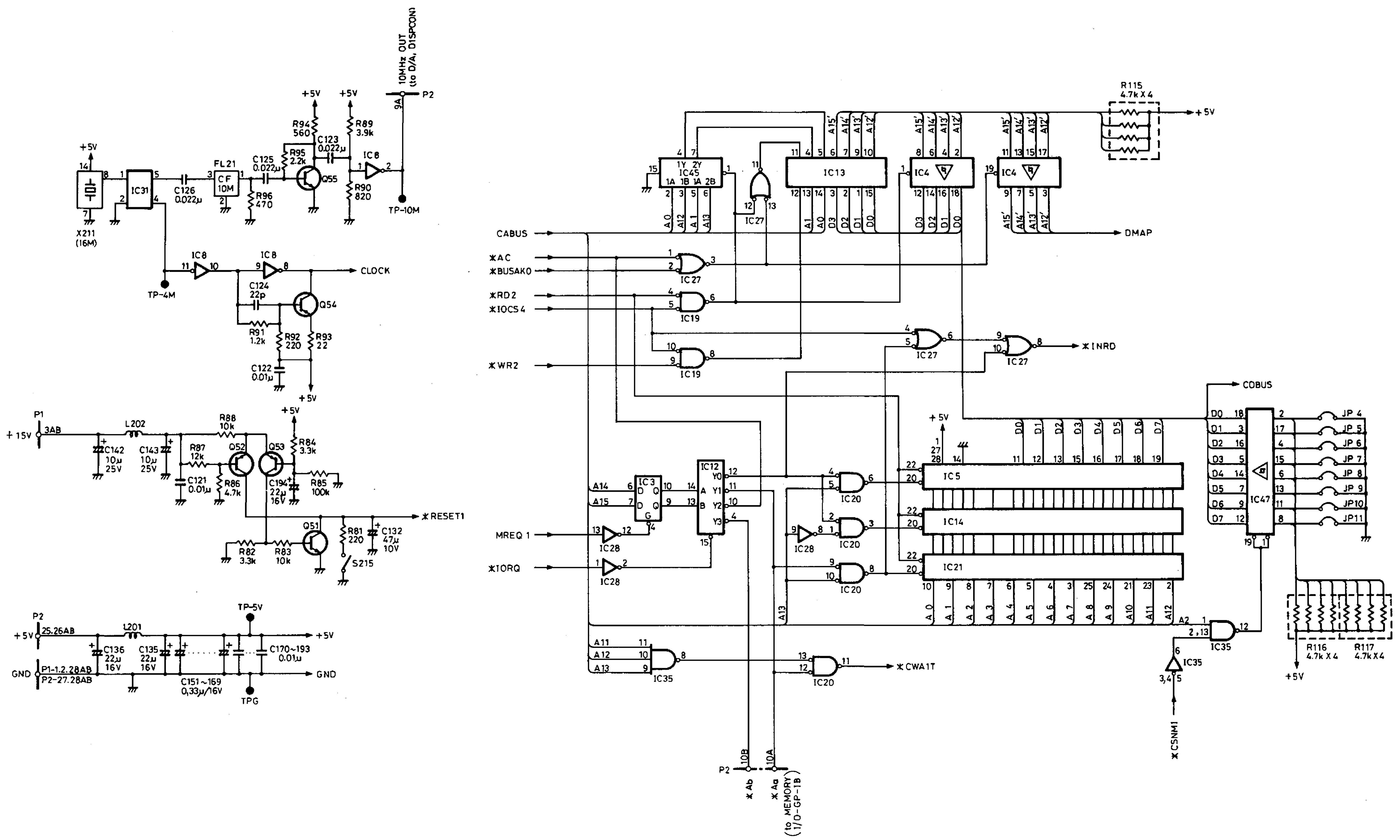
TR4172/4173/4173E
GP–IB SWITCH
BLB - 010206



TR4172/4173/4173E

19 CPU

BGP-010191 1/2

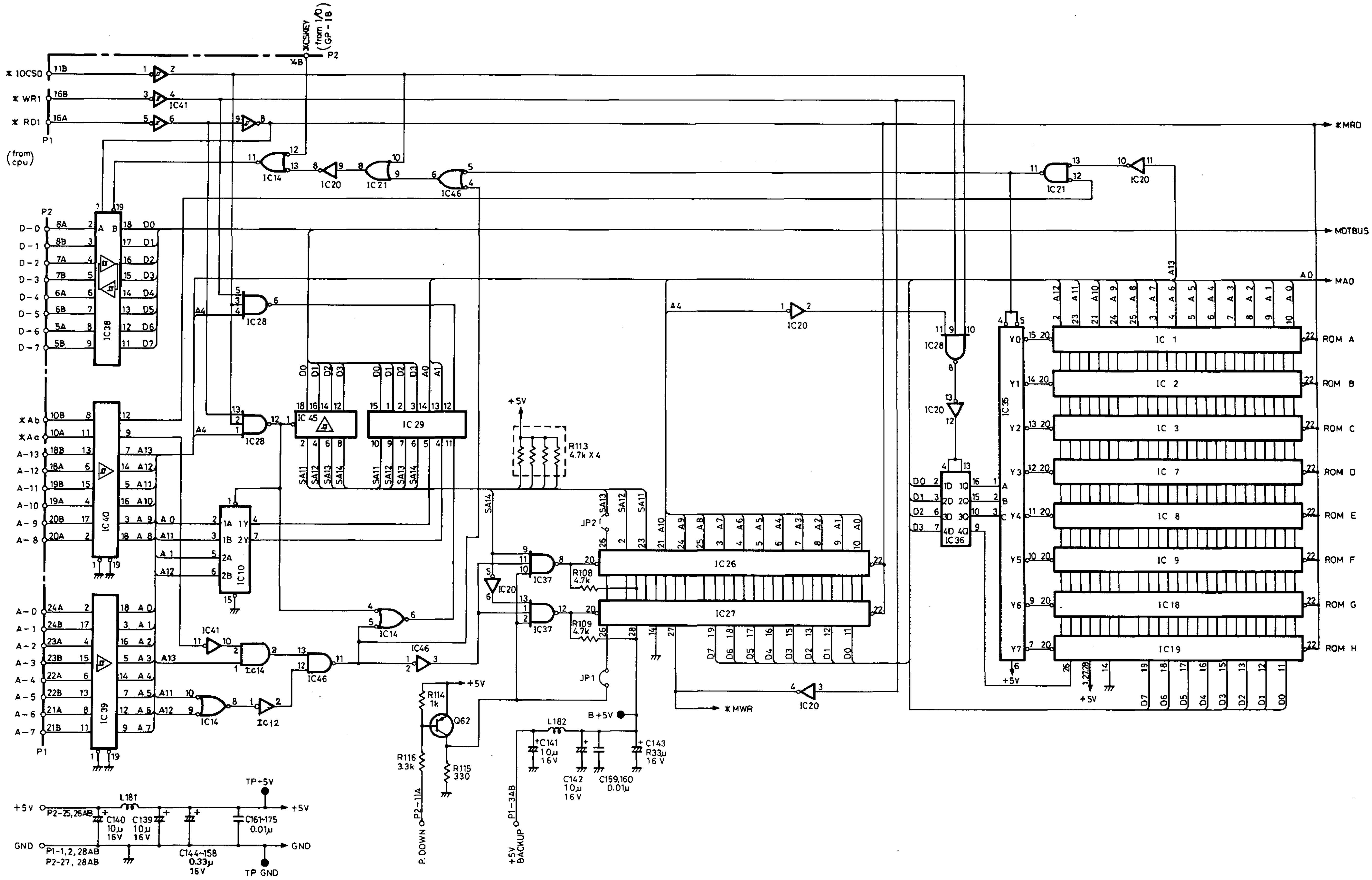


0069311-020-B

TR4172/4173/4173E

20 CPU

BGP-010191 2/2

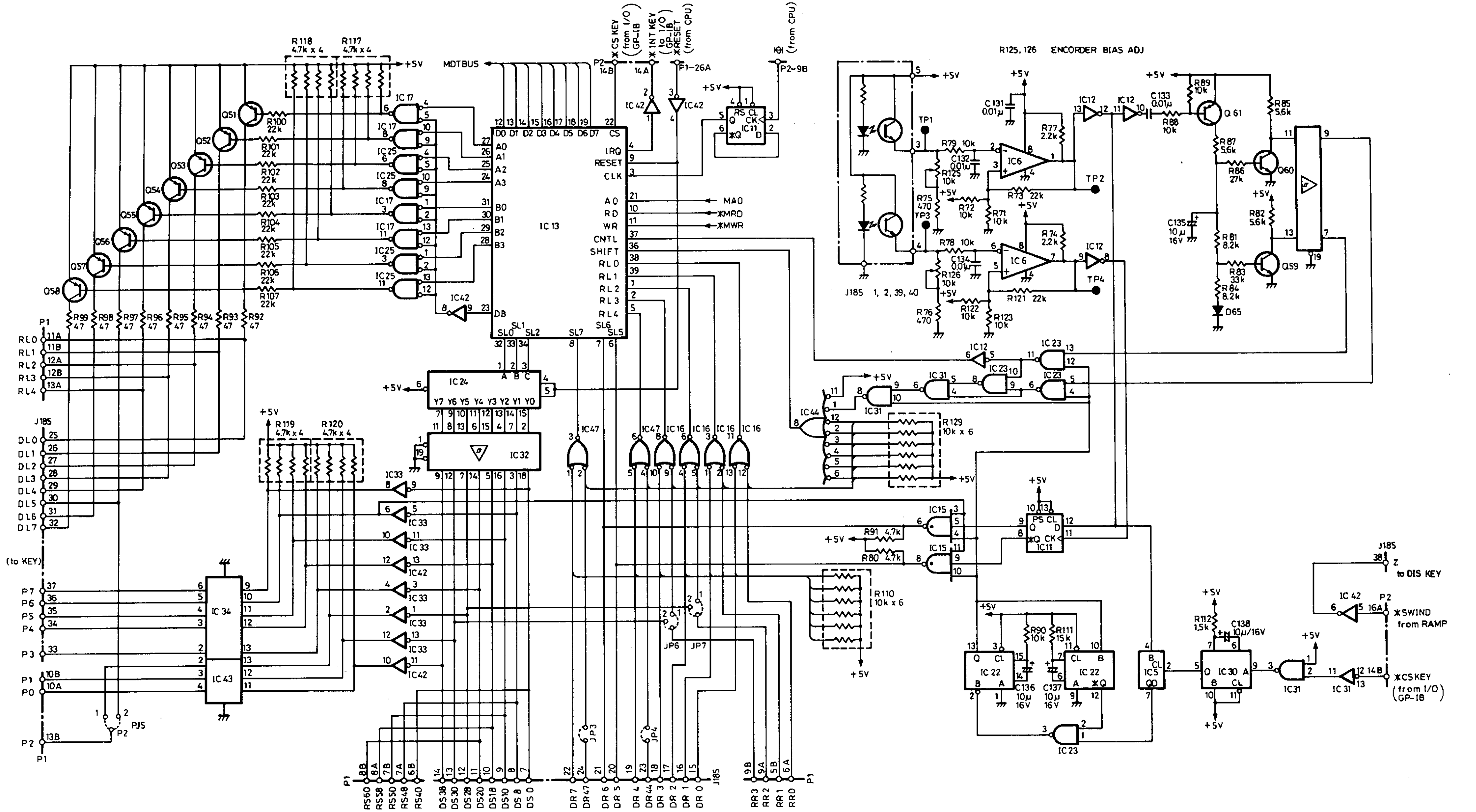


0069311-021-D

TR4172/4173/4173E

21 MEMORY

BGP−010192 1/2



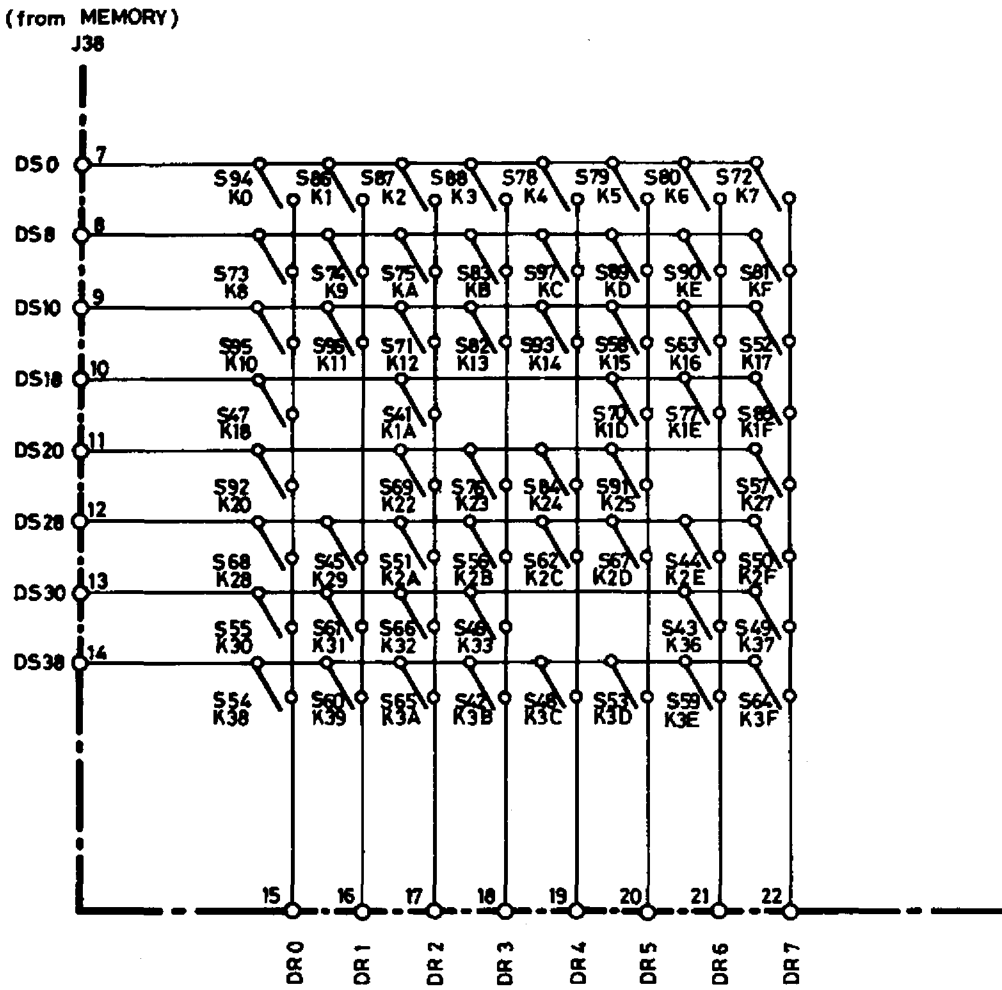
	4172
JP 3	open
JP 4	open
JP 5	P2—2
JP 6	RR3—2
JP 7	RR2—2

0069311-022-C

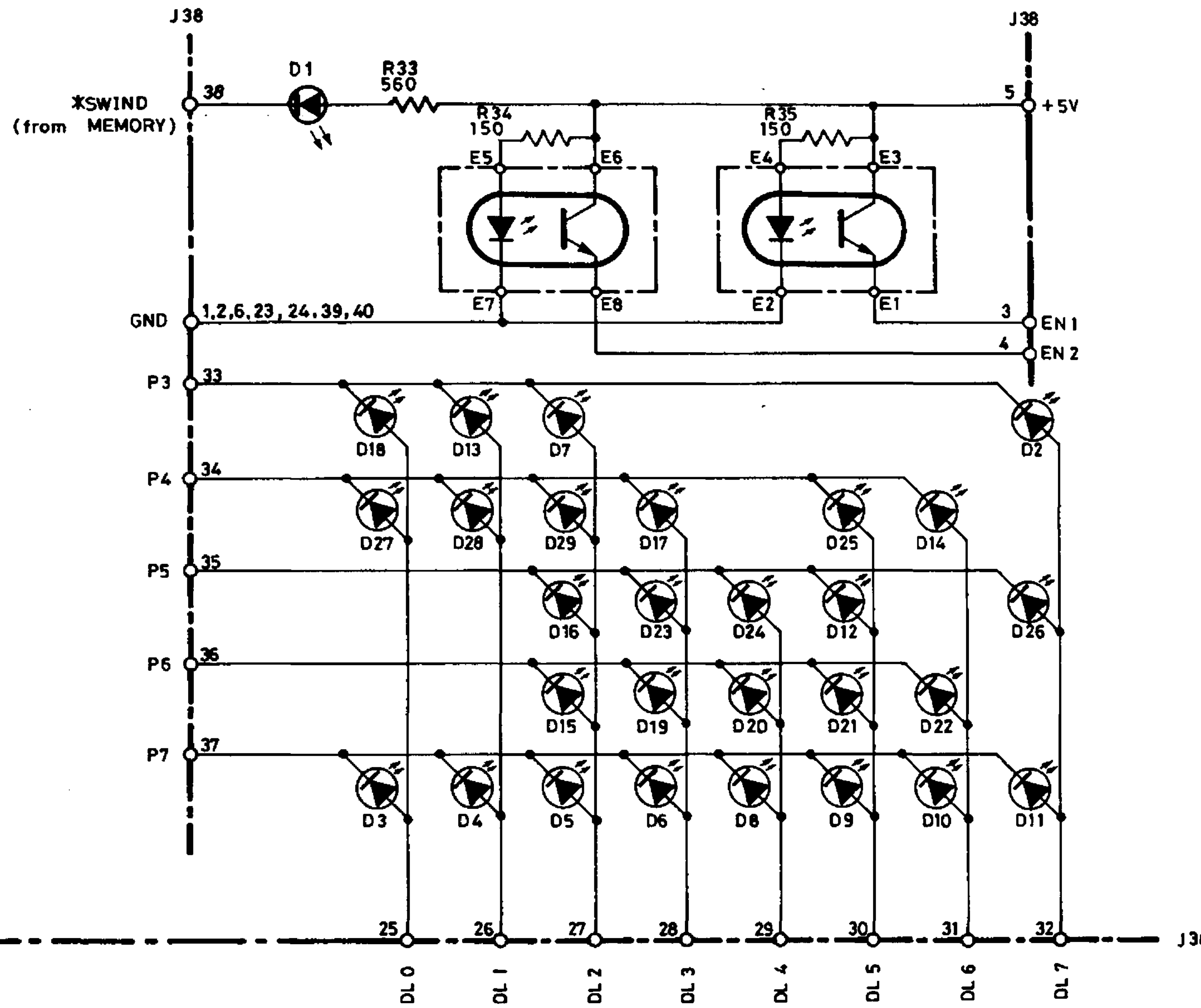
TR4172/4173/4173E

22 **MEMORY**

BGP—010192 2/2

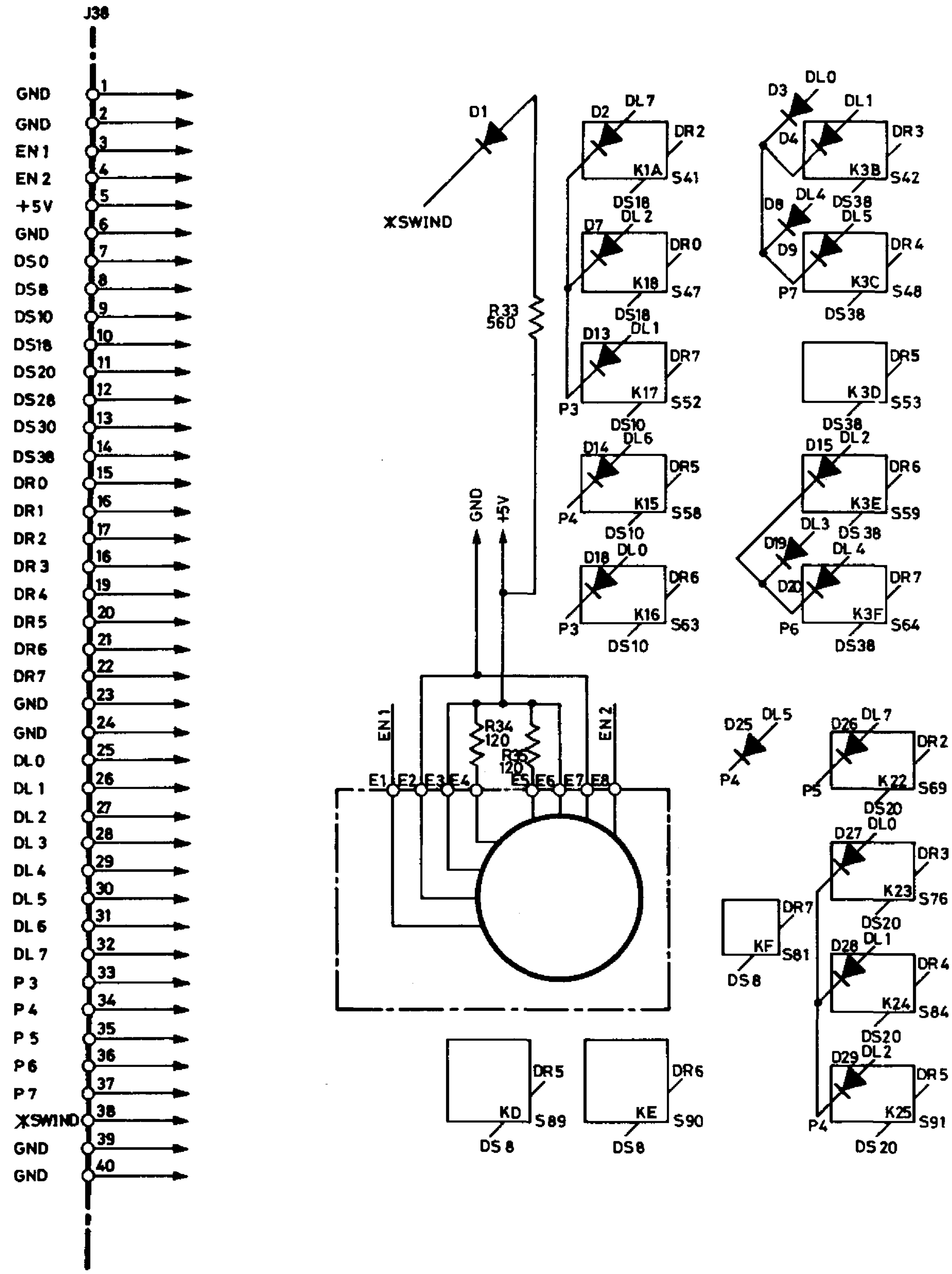


0069209-023-A

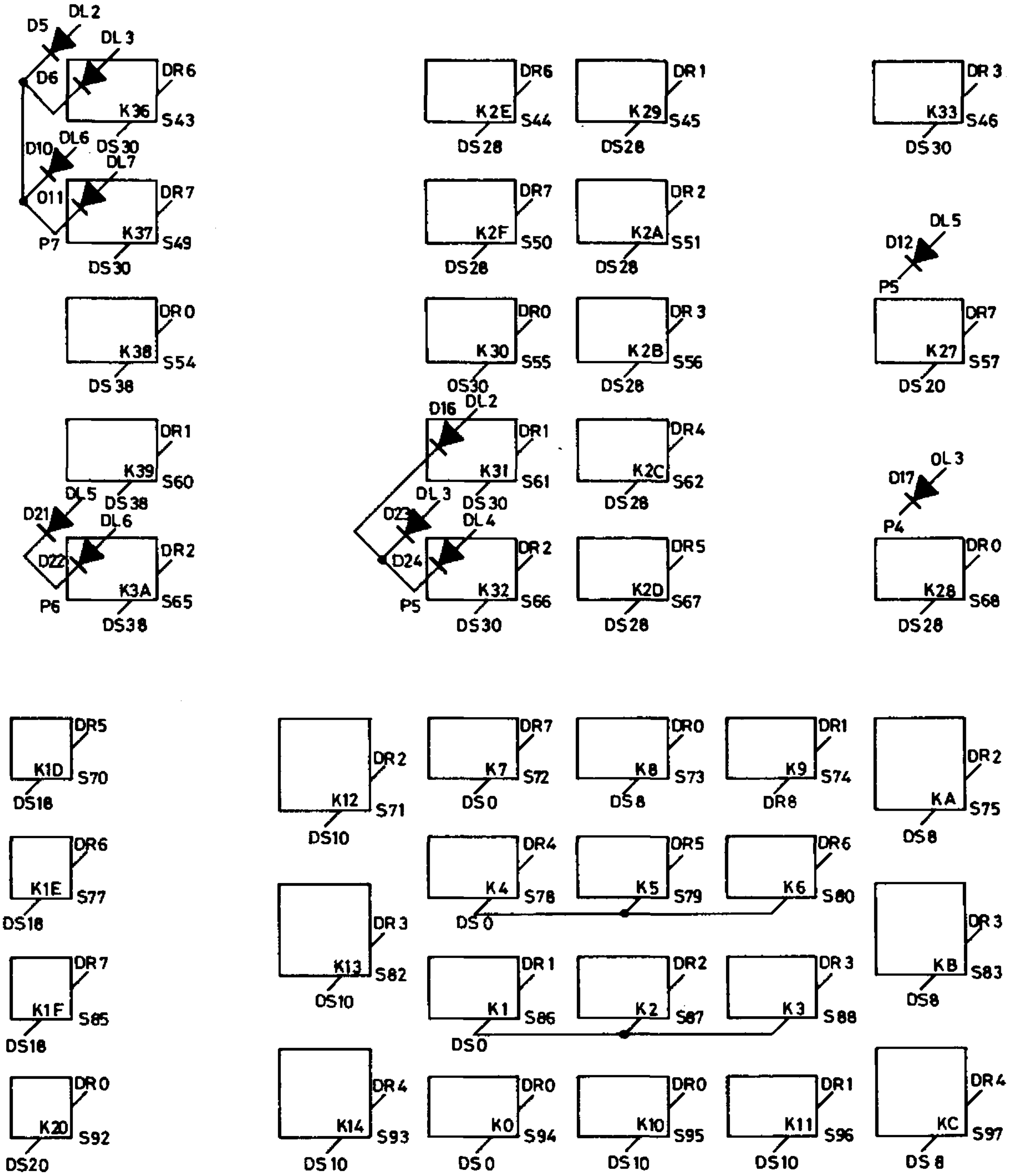


23

TR4172
DISPLAY KEY
BLG−010240 1/2

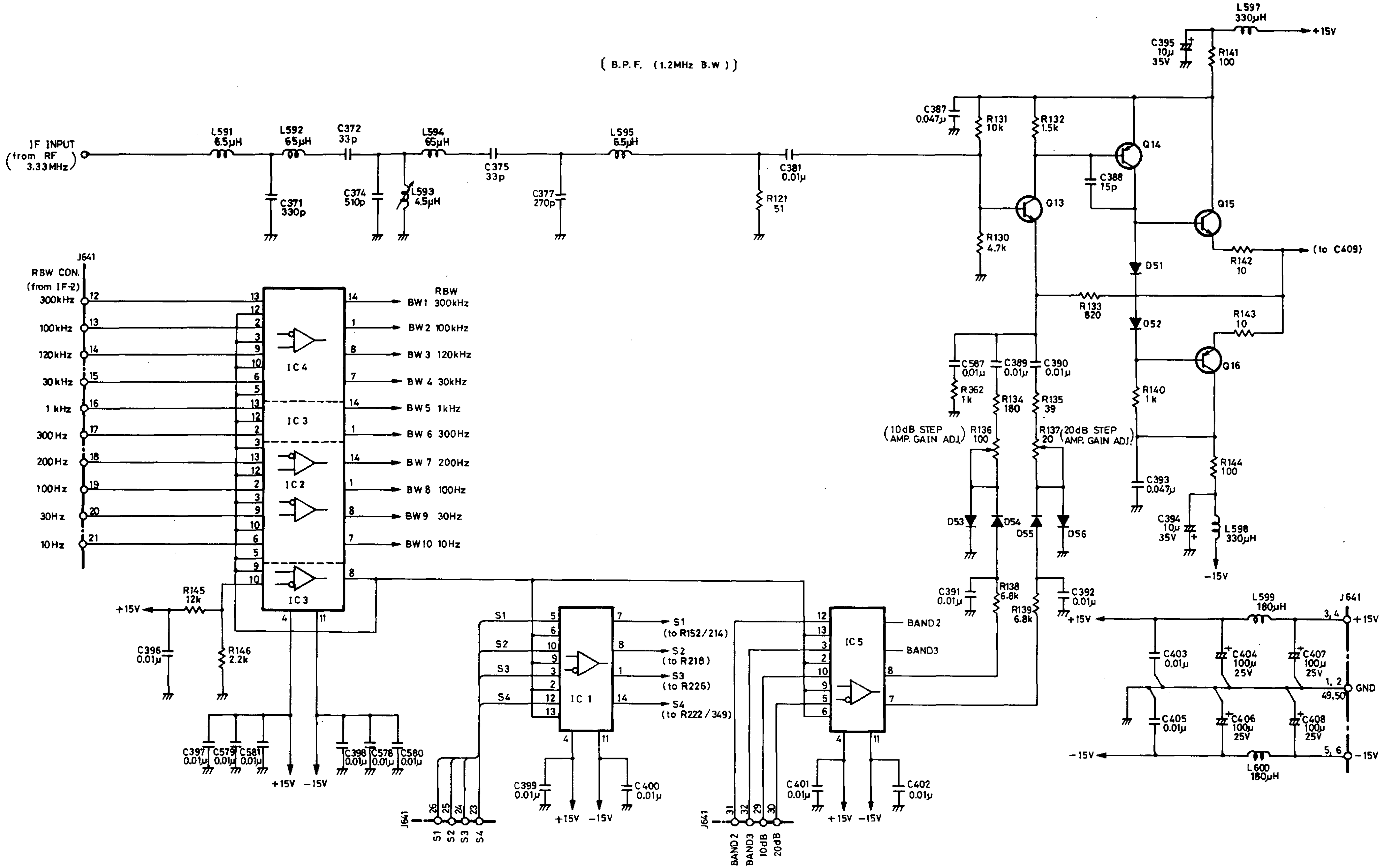


0069209 — 024 — A



24

TR4172
DISPLAY KEY (LOCATION)
BLG−010240 2/2

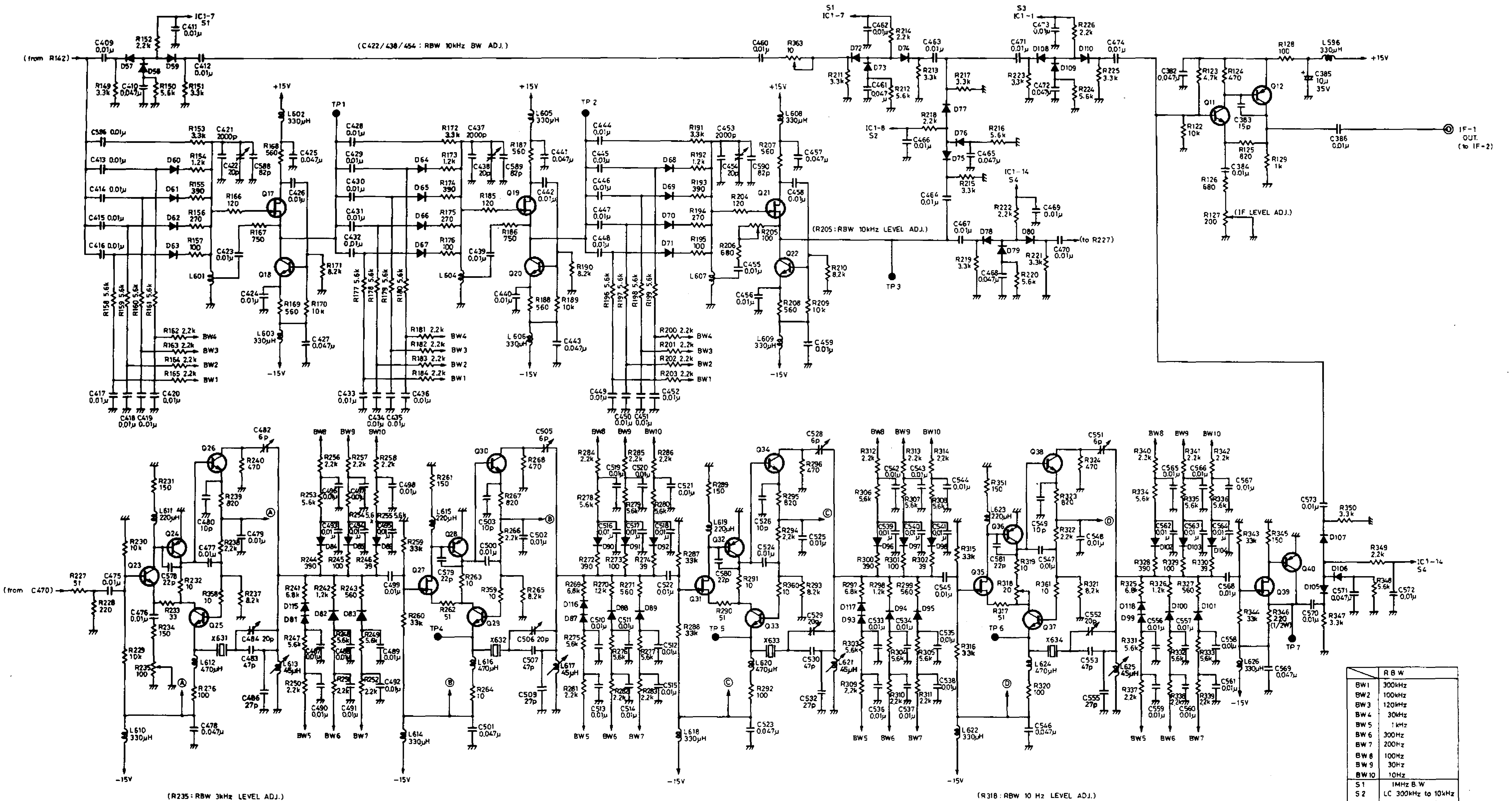


0069308-025-D

TR4172/4173/4173E

25 **IF-1**

BLP-010229 1/2



	RBW
BW1	300kHz
BW2	100kHz
BW3	120kHz
BW4	30kHz
BW5	1kHz
BW6	300Hz
BW7	200Hz
BW8	100Hz
BW9	30Hz
BW10	10Hz
S1	1MHz B.W
S2	LC 300kHz to 10kHz
S3	LC 1MHz to 10kHz
S4	Xtal 3kHz to 10kHz

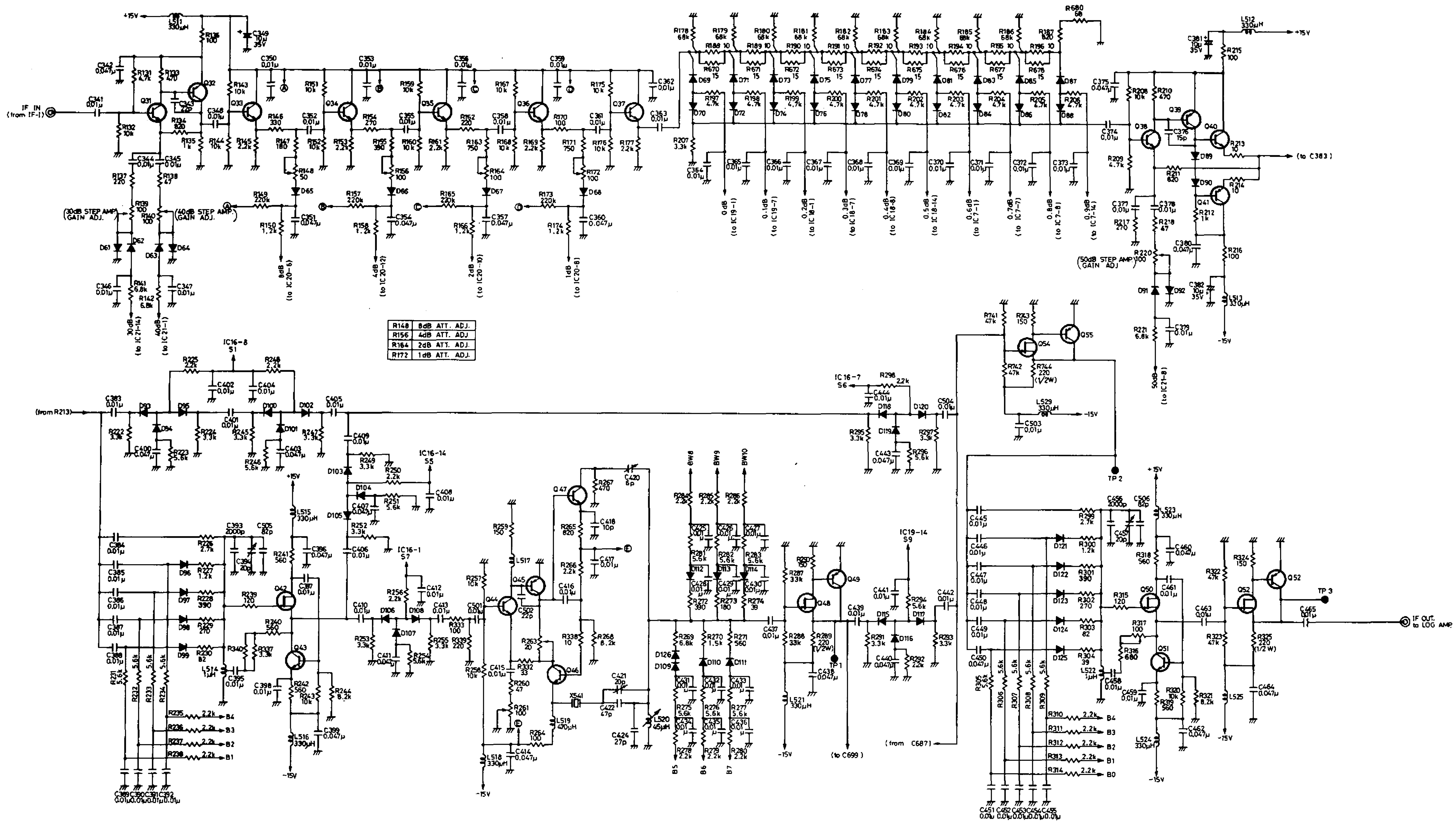
C482/505/528/551	RBW 3kHz SYMMETRY ADJ.
C484/506/529/552	RBW 10Hz CENTER FREQ. ADJ.
C486/509/532/555	RBW 3kHz BW ADJ.

0069403-026-F

TR4172/4173/4173E

26 IF-1

BLP-010229 2/2



R148	8dB ATT. ADJ.
R156	4dB ATT. ADJ.
R164	2dB ATT. ADJ.
R172	1dB ATT. ADJ.

(C394/457 : RBW 10kHz BW ADJ.)

(R261 : QP 9kHz LEVEL ADJ.
R263 : RBW 10 Hz LEVEL ADJ.)

(C420 : RBW 3kHz SYMMETRY ADJ.
C421 : RBW 10Hz FREQ. ADJ.)

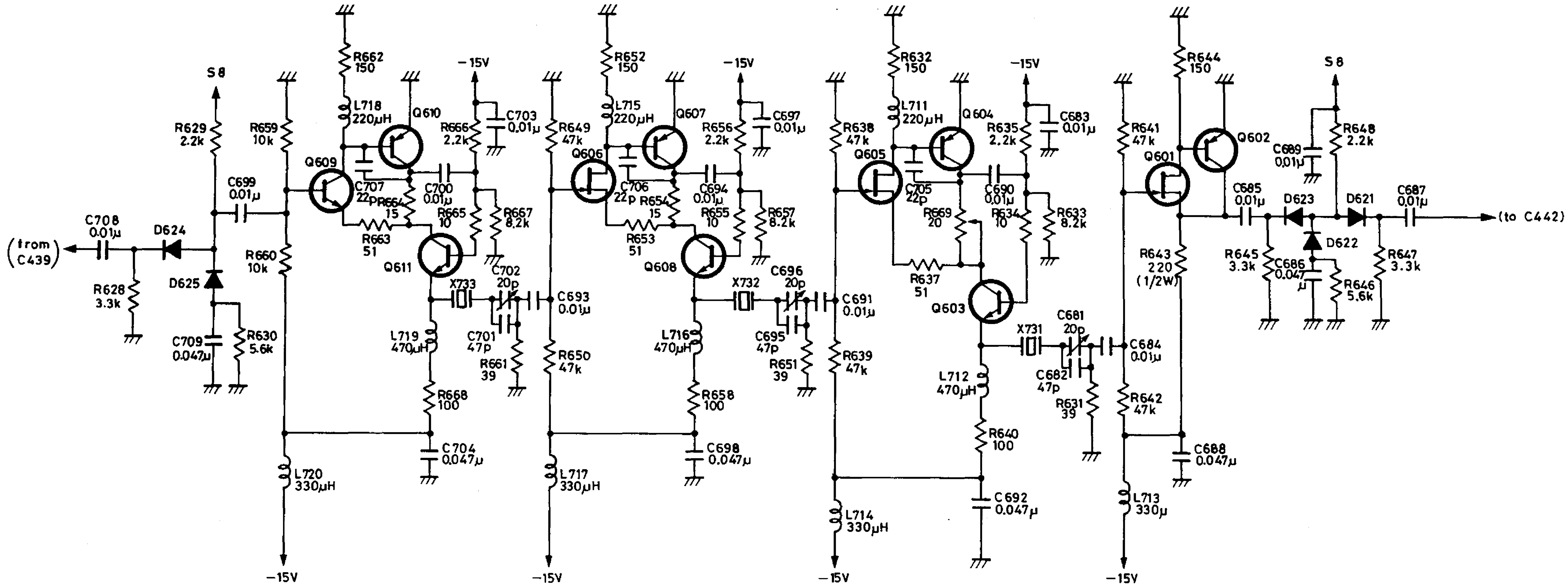
(R317 : RBW 10kHz LEVEL ADJ.)

0069401-027-F

TR4172/4173/4173E

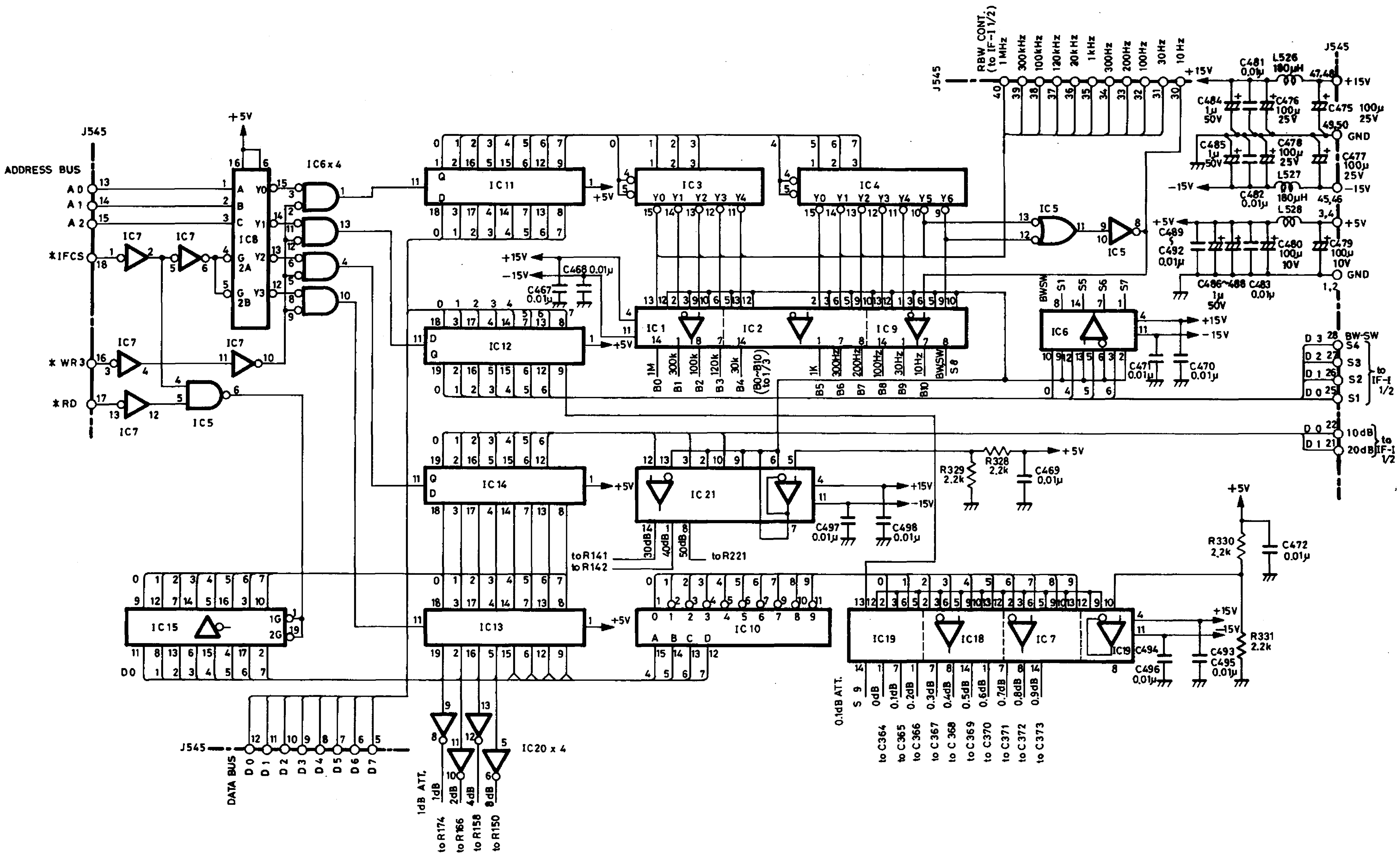
27 IF-2

BLP-010230 1/3



(C702/676/681 : RBW 7Hz CENTER FREQ. ADJ.)

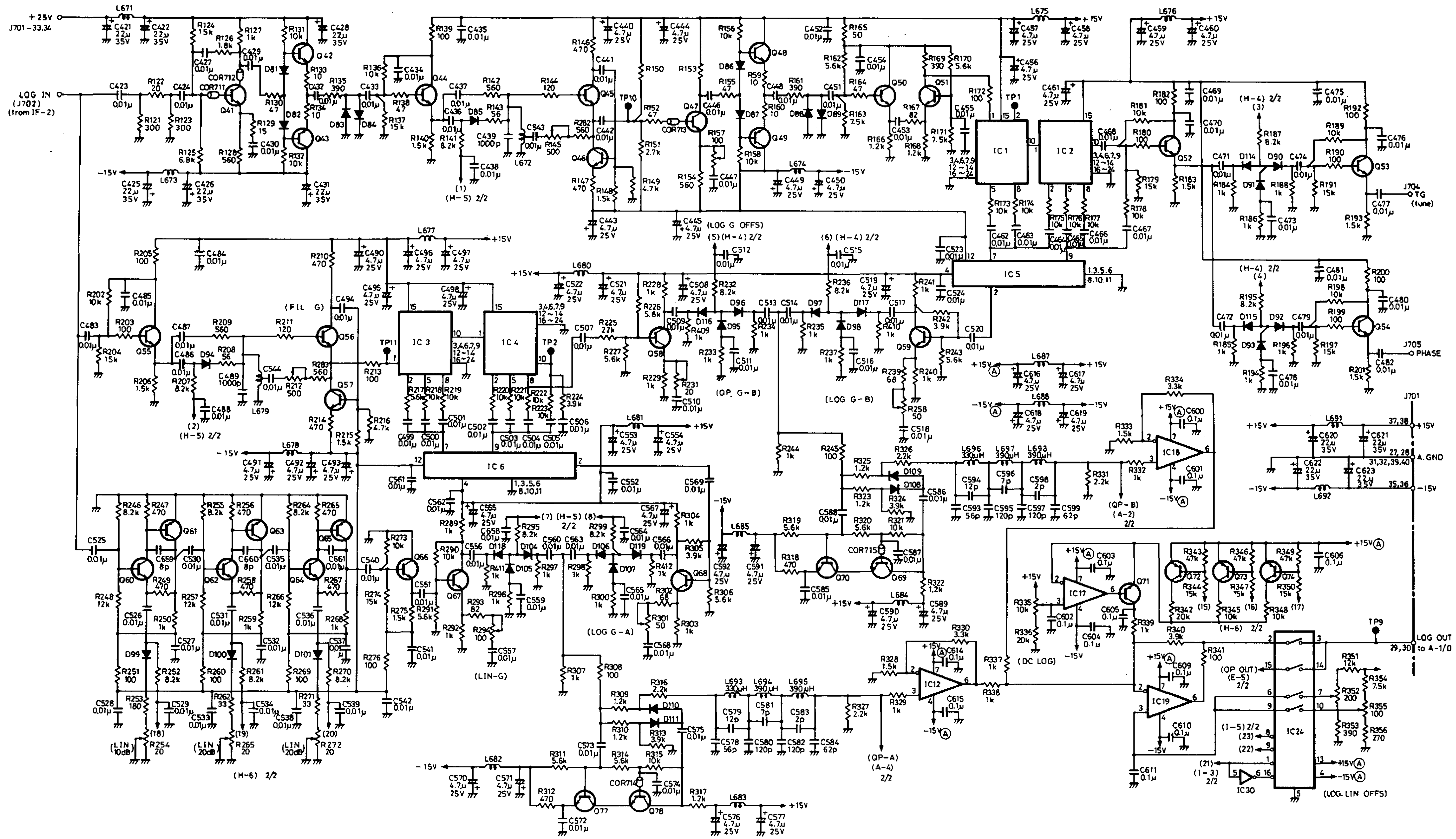
0069401 −028− C



0069308 —029—C

29

TR4172 /4173/4173E
IF—2
BLP—010230 3/3

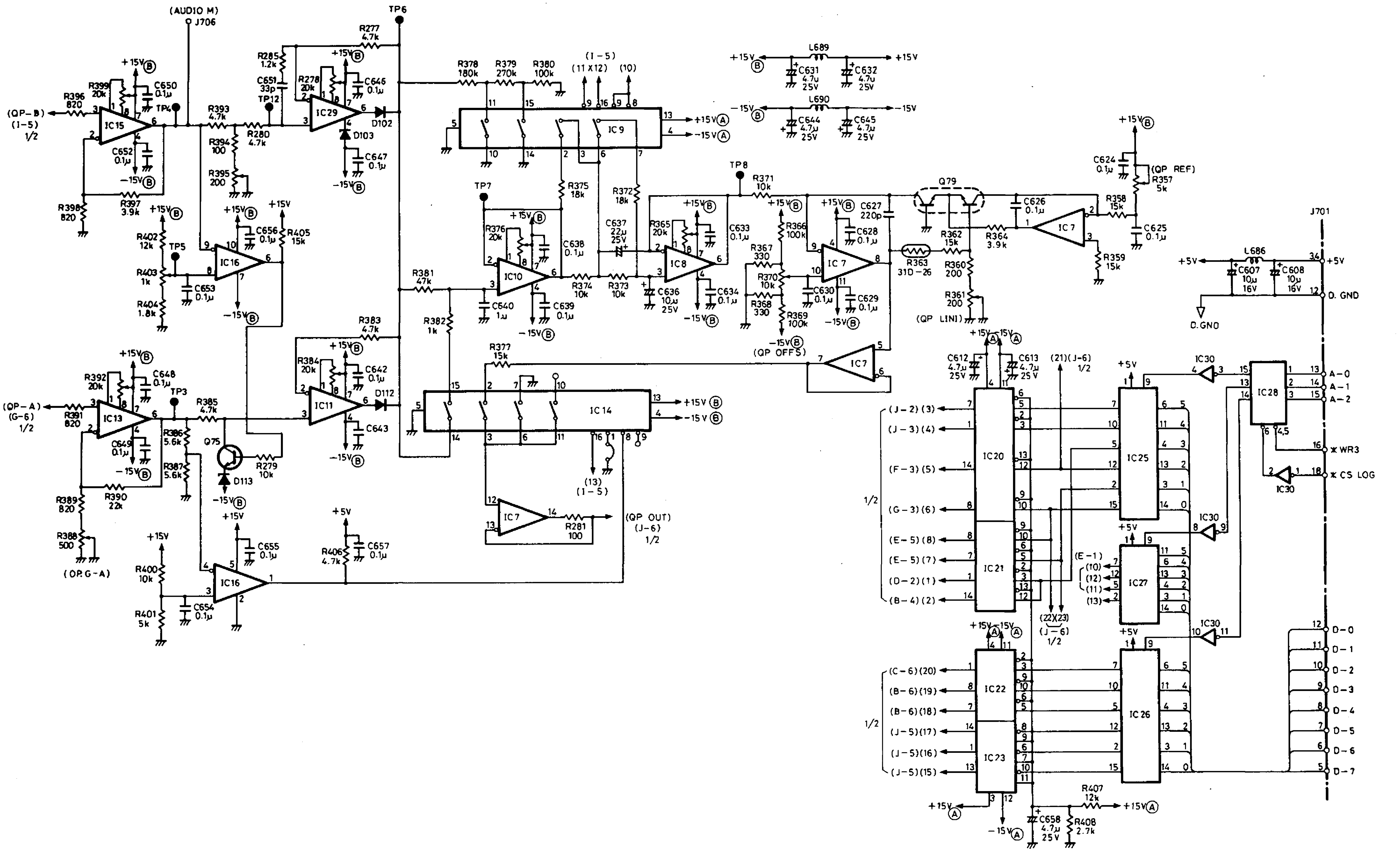


TR4172/4173/4173E

30 LOG AMP

BLP-010231 1/2

0069311-030-C

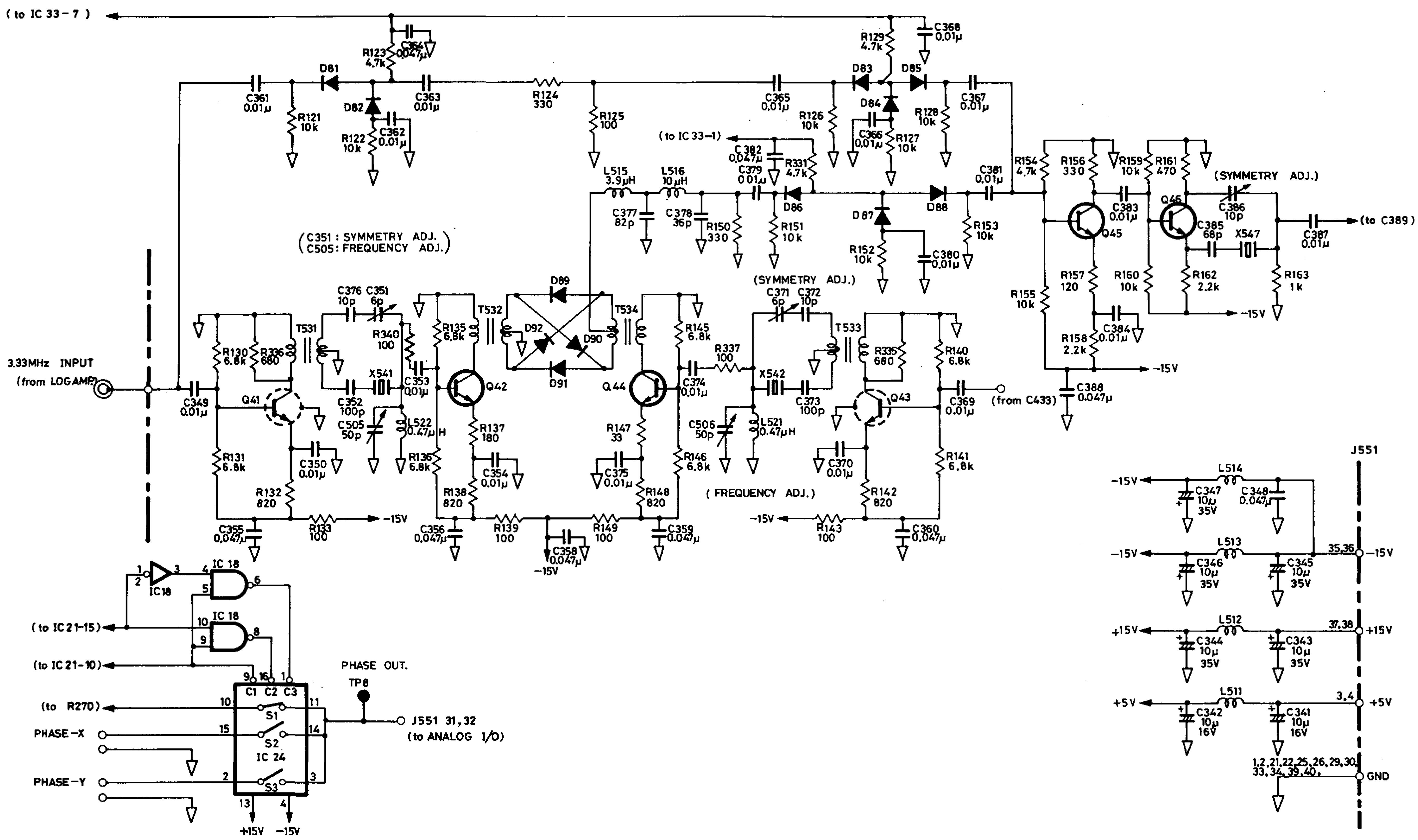


TR4172/4173/4173E

30' LOG AMP

BLP-010231 2/2

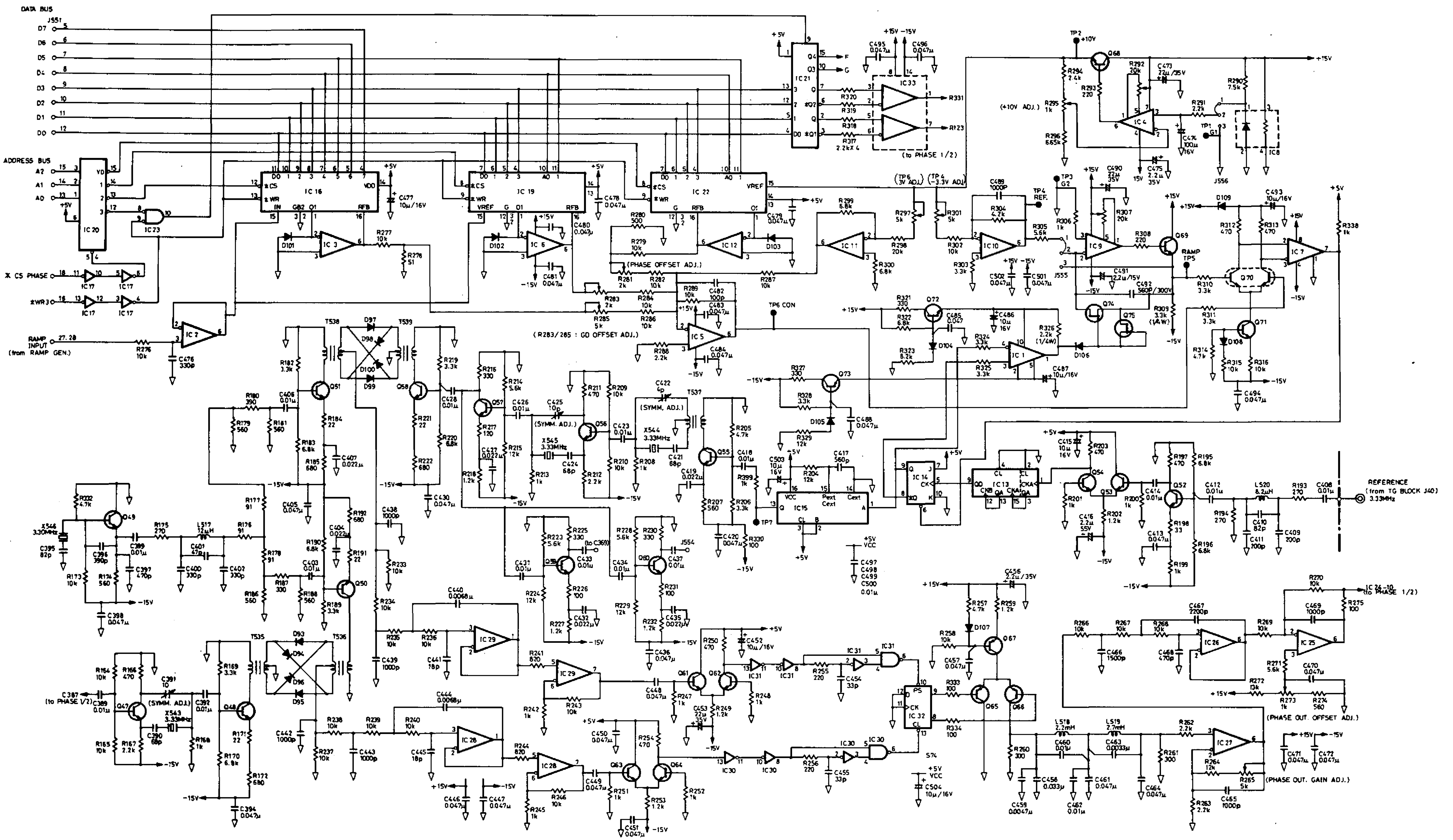
0069402-030'-D



TR4172 /4173/4173E
PHASE
BLP-010205 1/2

31

0069305-031-C

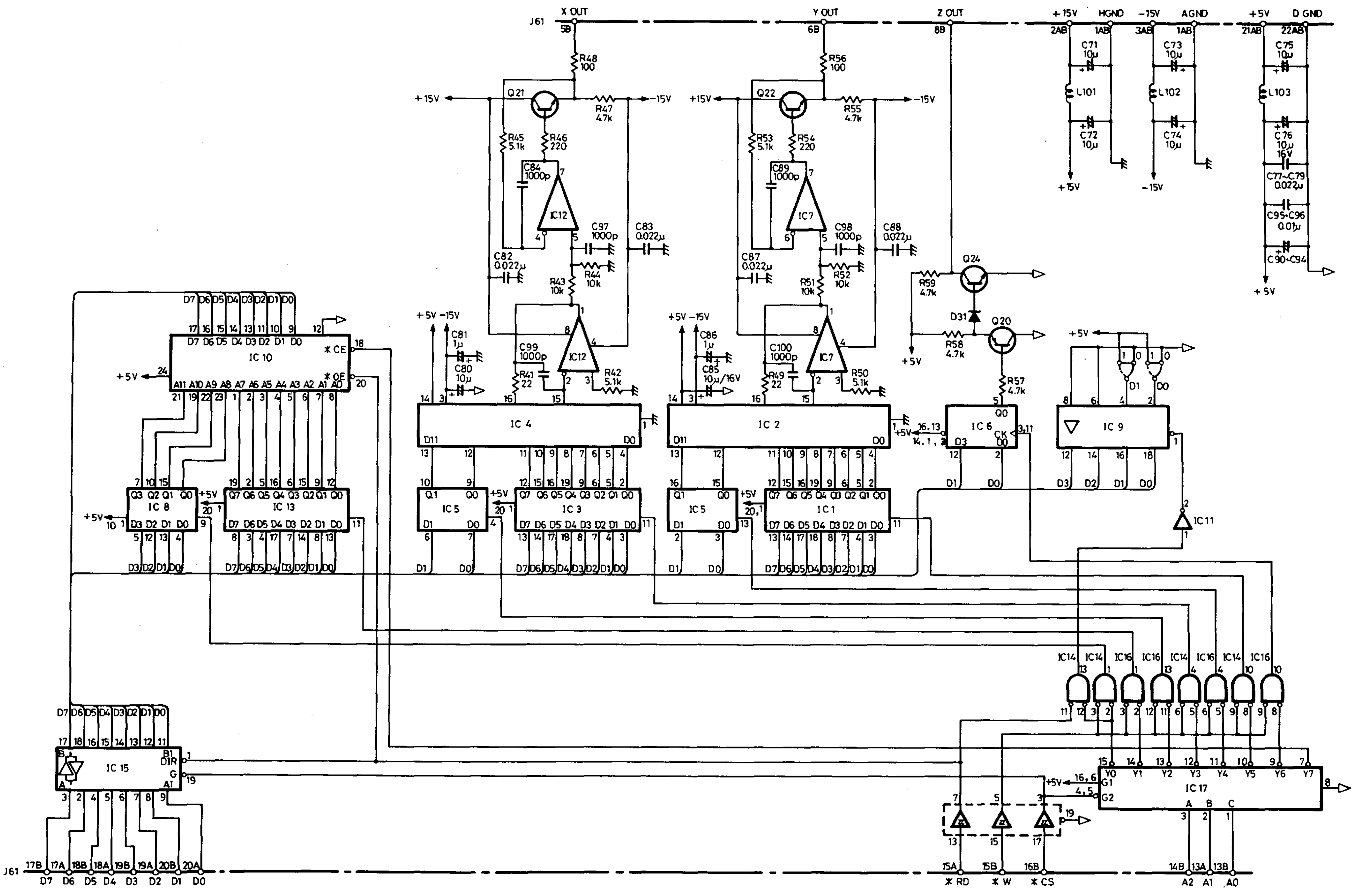


0069304-032-C

TR4172/4173/4173E

32 PHASE

BLP-010205 2/2



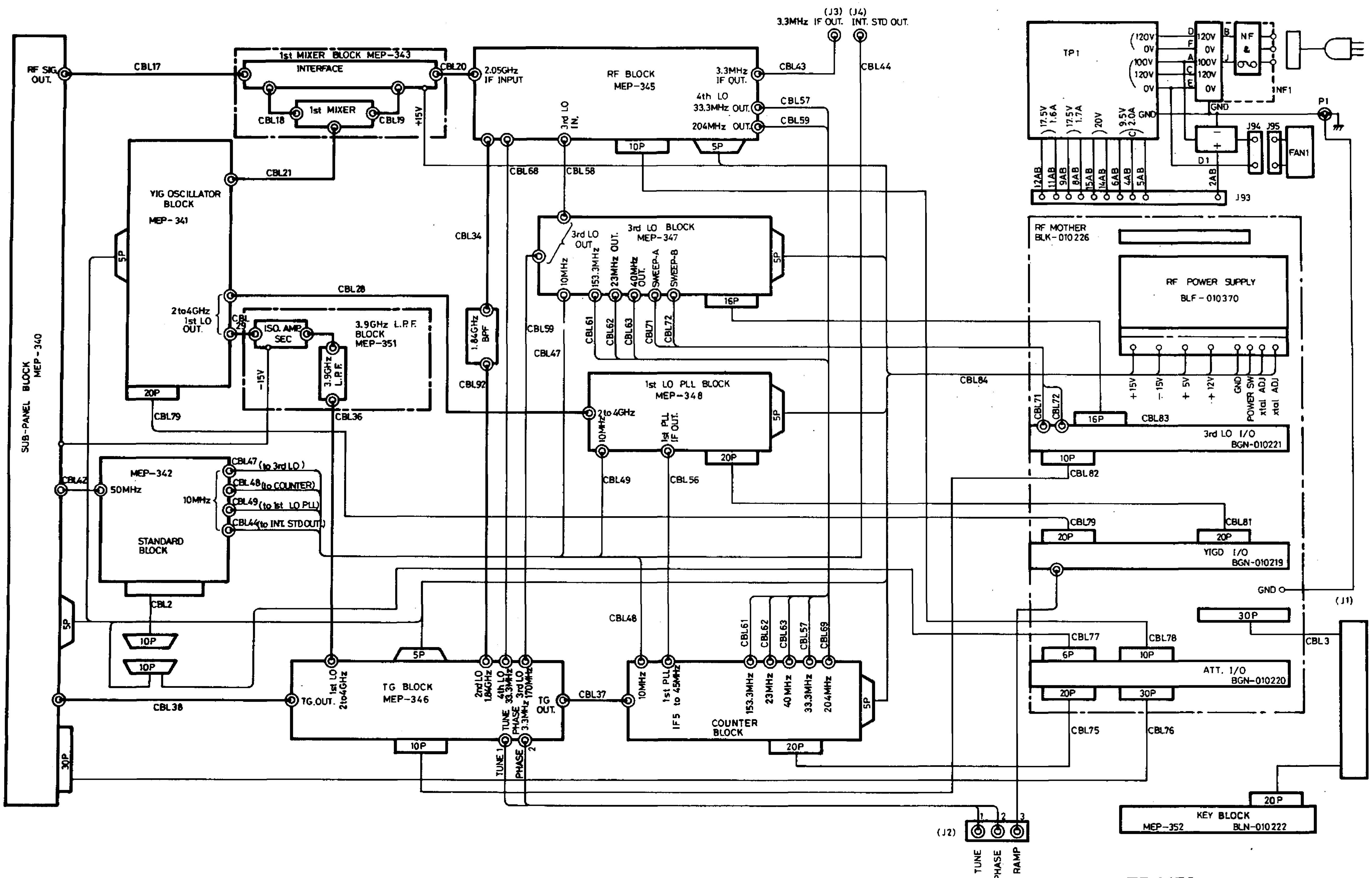
00692111- 033-B

<33>

TR4172

X-Y RECODER OPTION I

BGC-010193

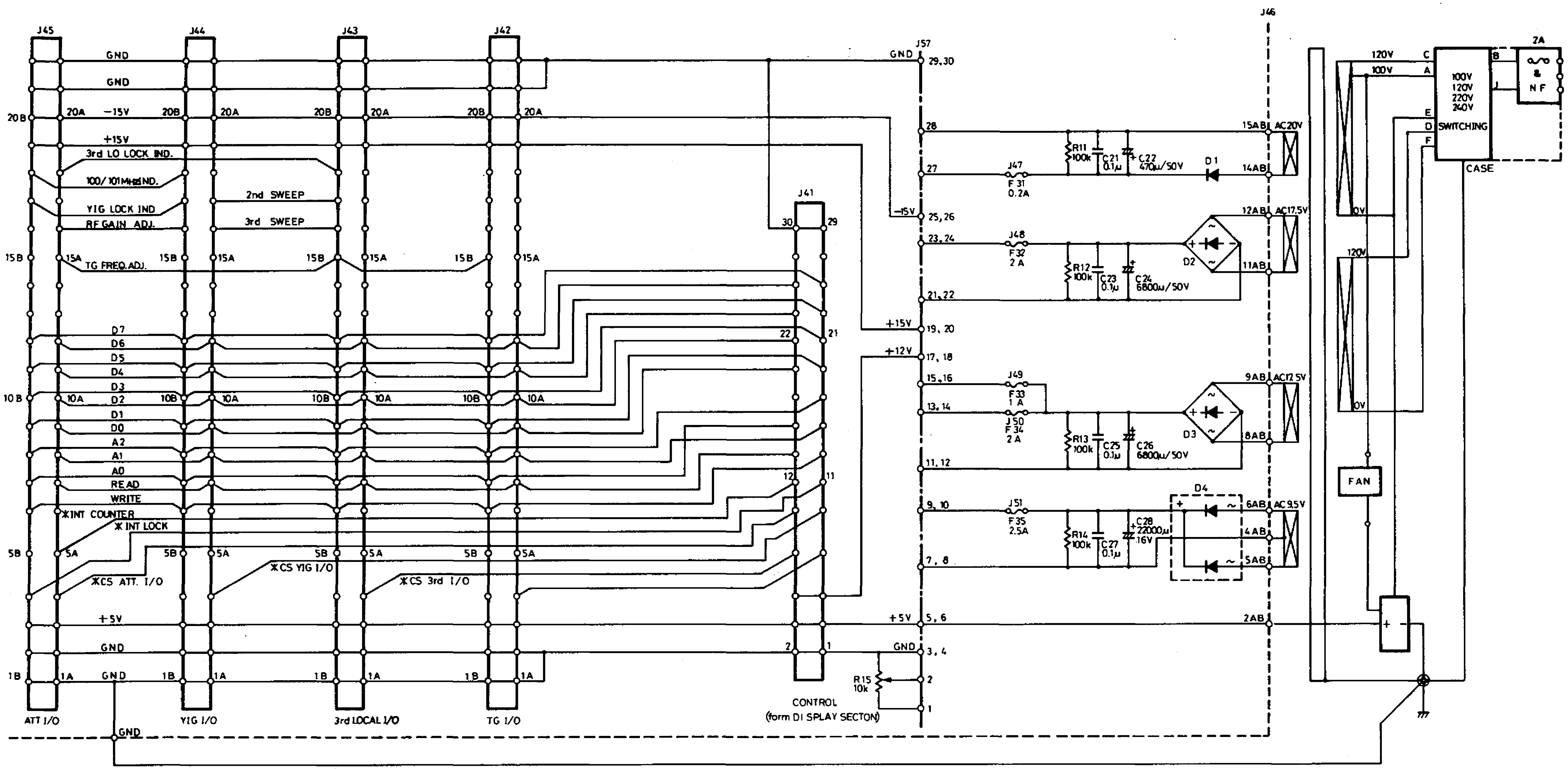


TR4172

<34> **RF SCHEMATIC SECTION**

TR4172-RE

0069209-034-B

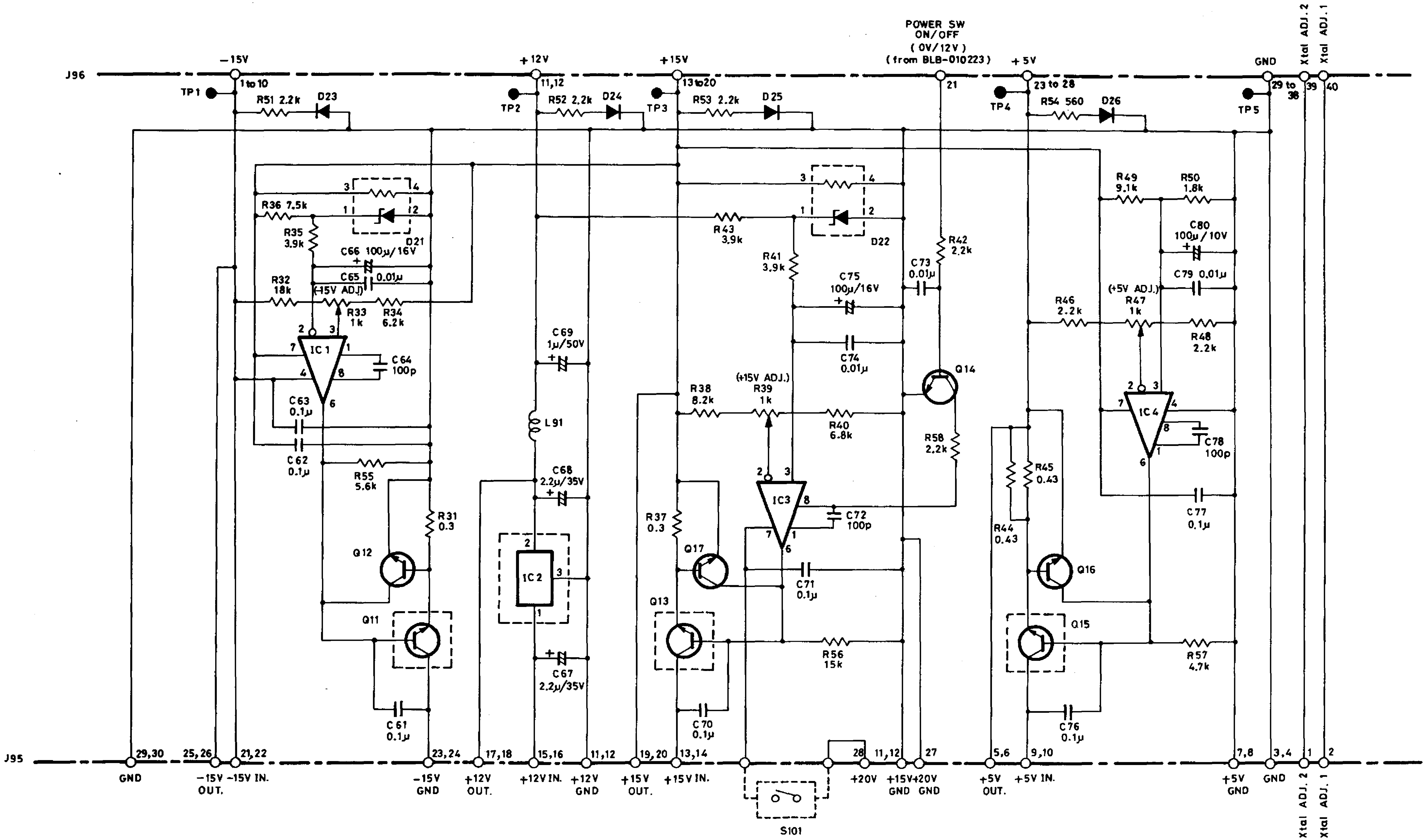


0069209-035-A

TR4172

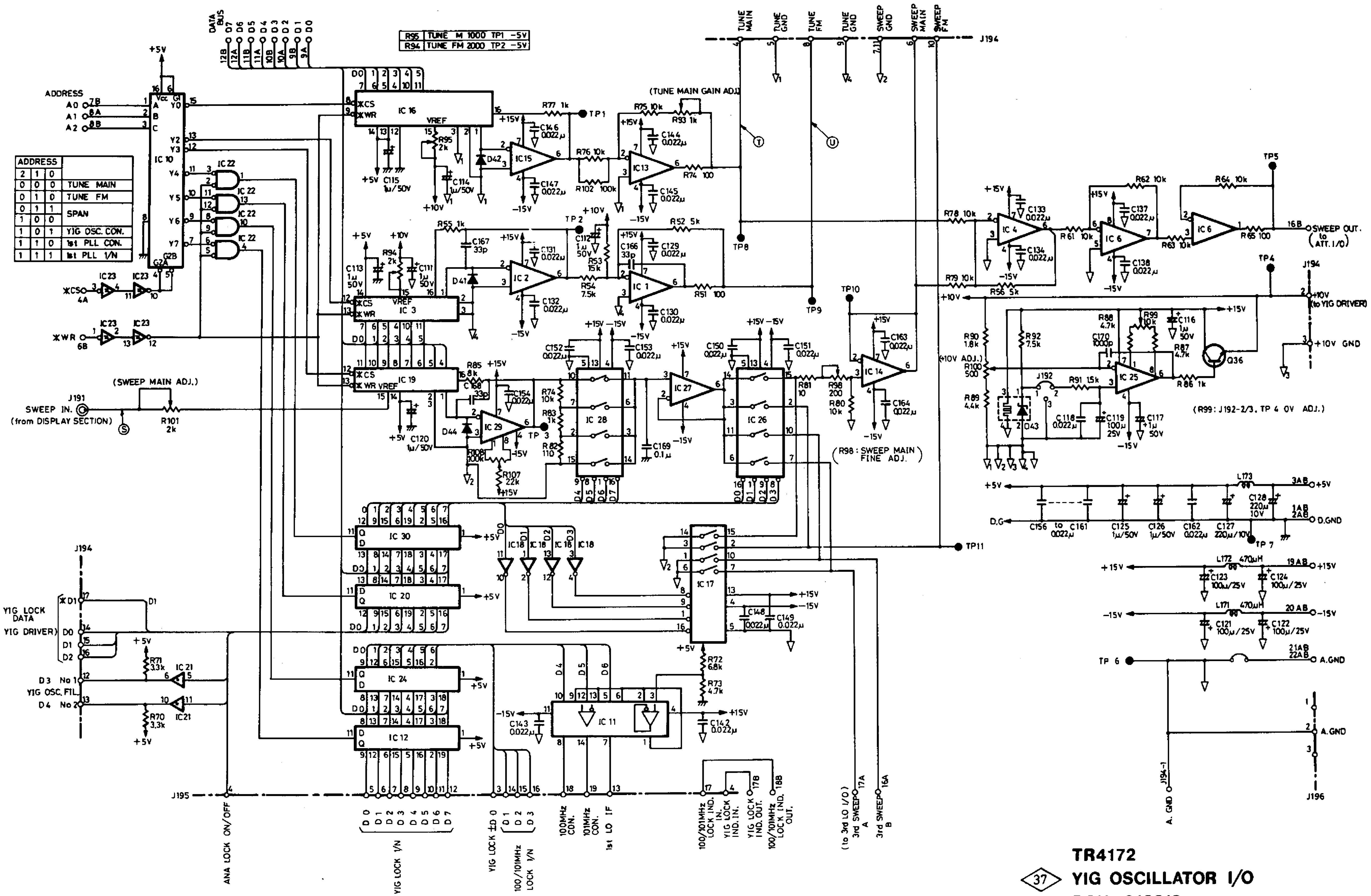
35 **RF MOTHER**

BLK-010226



0069209-036- A

36 TR4172
RF POWER
BLF-010370

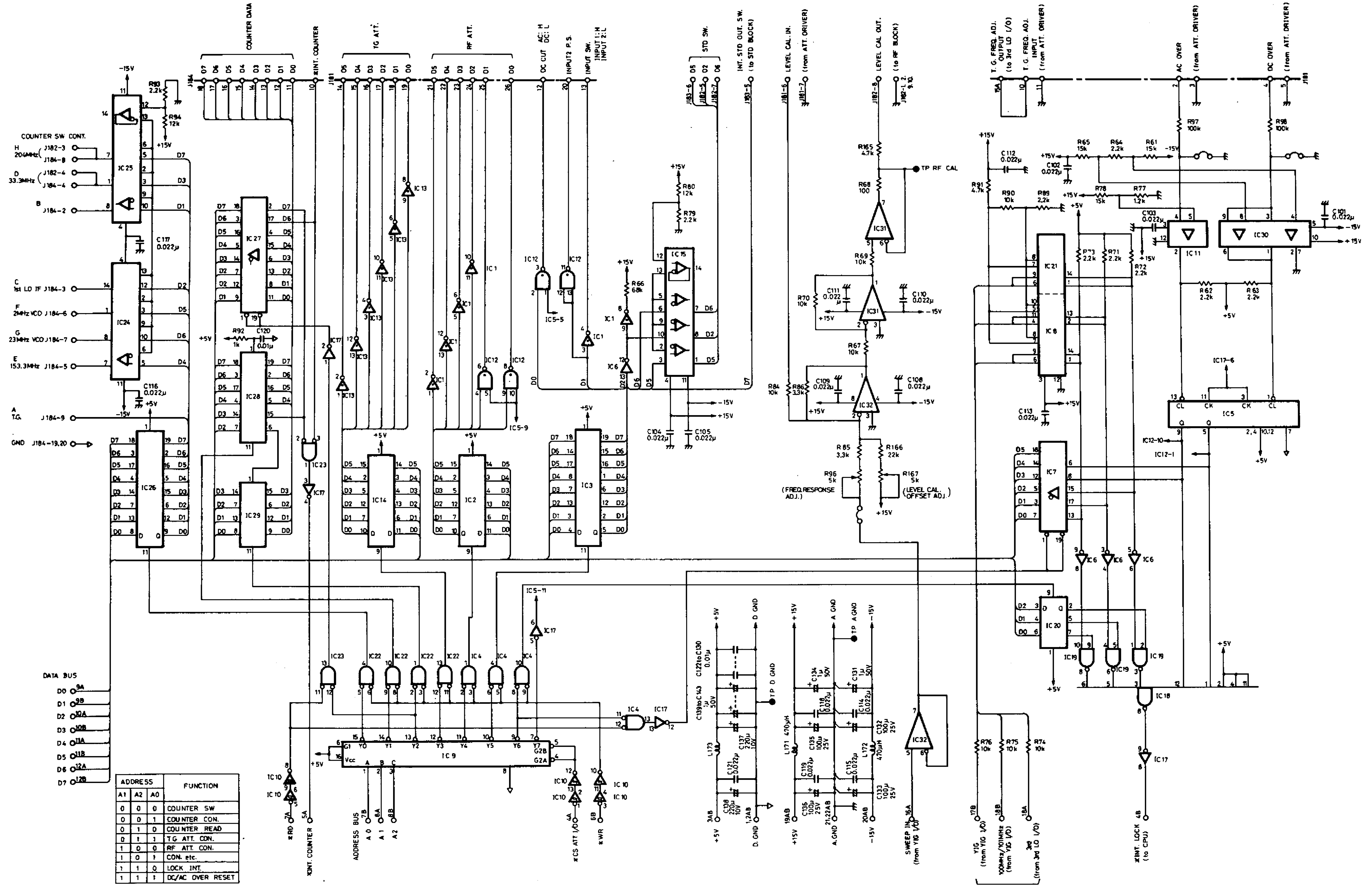


0069311-037-D

TR4172

37 **YIG OSCILLATOR I/O**

BGN-010219

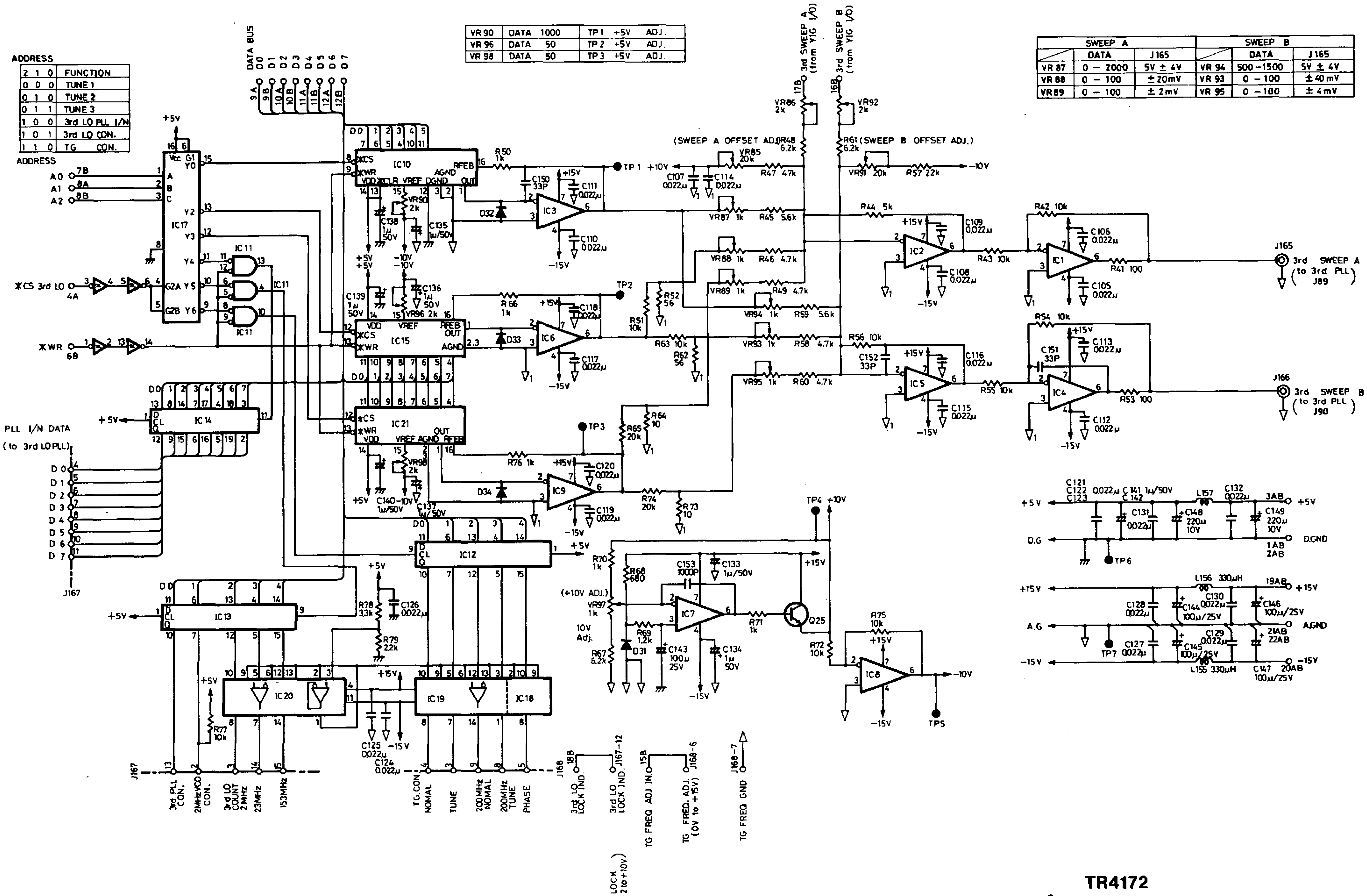


ADDRESS			FUNCTION
A1	A2	A0	
0	0	0	COUNTER SW
0	0	1	COUNTER CON.
0	1	0	COUNTER READ
0	1	1	T.G ATT. CON.
1	0	0	RF ATT. CON.
1	0	1	CON. etc.
1	1	0	LOCK INT.
1	1	1	DC/AC OVER RESET

0069209-038-B

38

TR4172
ATTENUATOR I/O
BGN-010220



2 1 0	FUNCTION
0 0 0	TUNE 1
0 1 0	TUNE 2
0 1 1	TUNE 3
1 0 0	3rd LO PLL I/N
1 0 1	3rd LO CON.
1 1 0	TG CON.

VR 90	DATA 1000	TP 1 +5V ADJ.
VR 96	DATA 50	TP 2 +5V ADJ.
VR 98	DATA 50	TP 3 +5V ADJ.

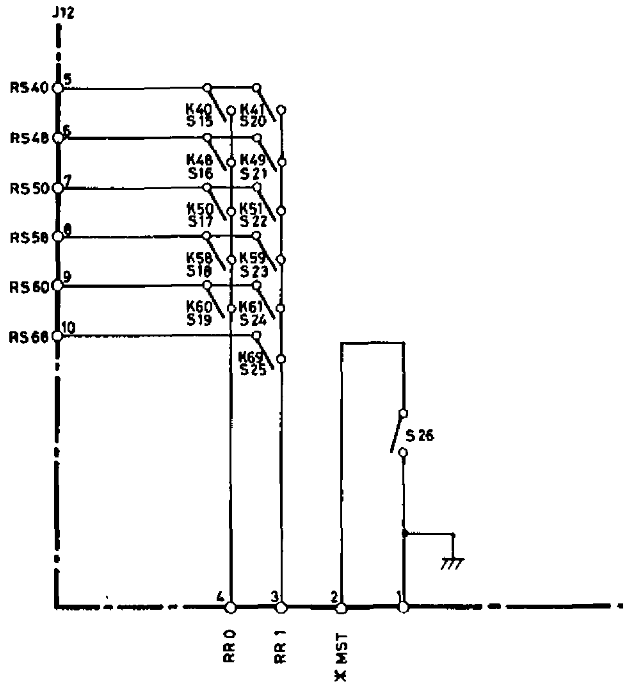
SWEEP A			SWEEP B		
	DATA	J165		DATA	J165
VR 87	0 – 2000	5V ± 4V	VR 94	500–1500	5V ± 4V
VR 88	0 – 100	± 20mV	VR 93	0 – 100	± 40mV
VR 89	0 – 100	± 2mV	VR 95	0 – 100	± 4mV

TR4172

39 **3rd LOCAL I/O**

BGN–010221

0069301 -039- B

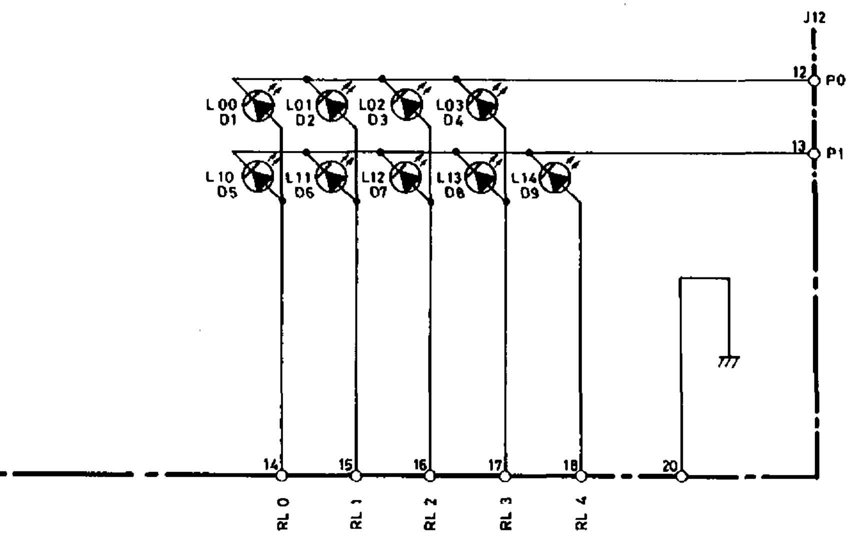


S15	RF ATT. AUTO
S16	RF ATT.
S17	INPUT 1 AC
S18	INPUT 1 DC
S19	INPUT 2
S20	NORMAL
S21	PHASE
S22	G. DELAY
S23	TG ATT. LEVEL
S24	TG
S25	LO REM
S26	MAST. RESET

0069209-040-A

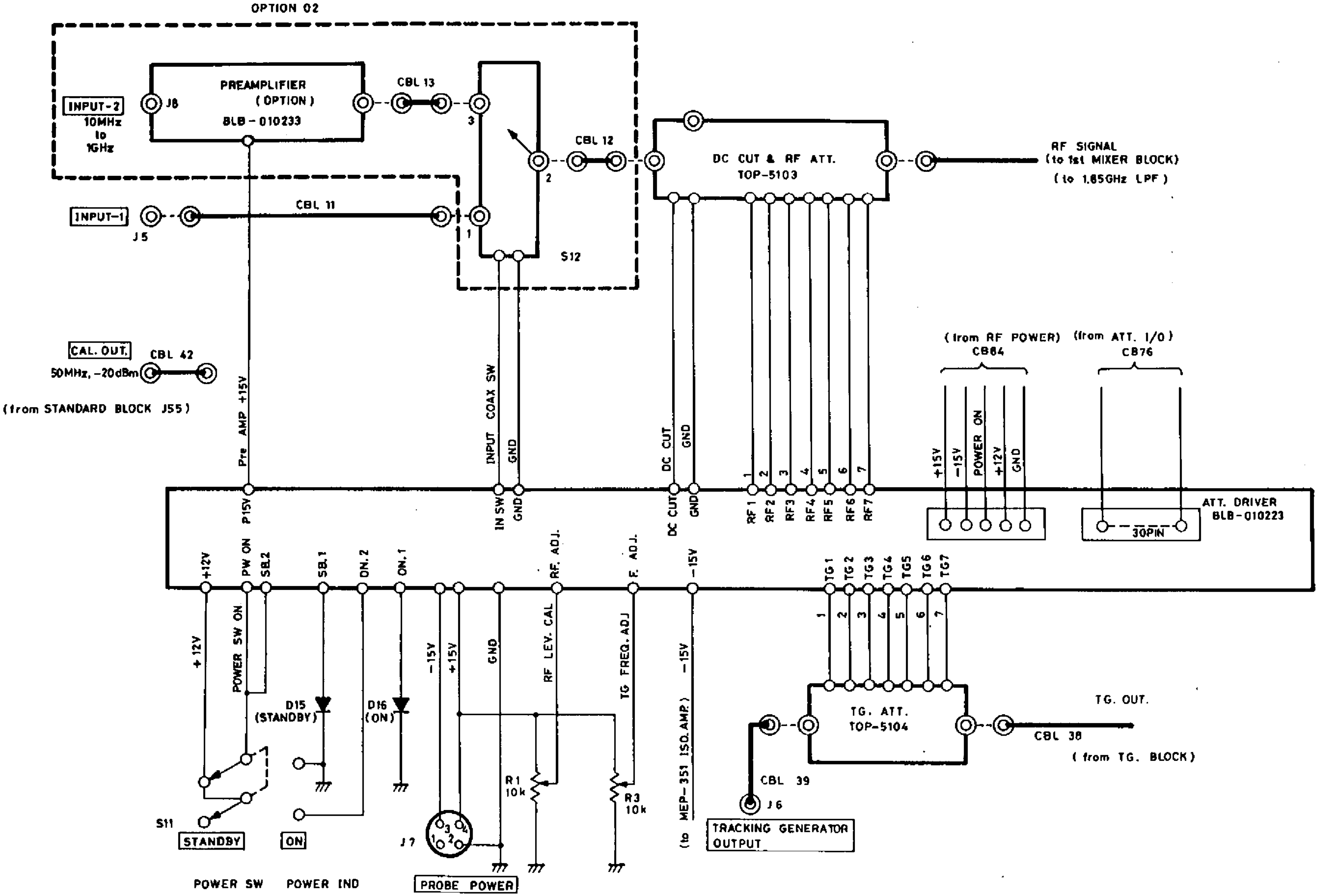
LED

L00	RF ATT.	L10	NORMAL
L01	INPUT-1 AC	L11	PHASE
L02	INPUT-1 DC	L12	G. DELAY
L03	INPUT-2	L13	TG ATT.
		L14	LO/REM



<40>

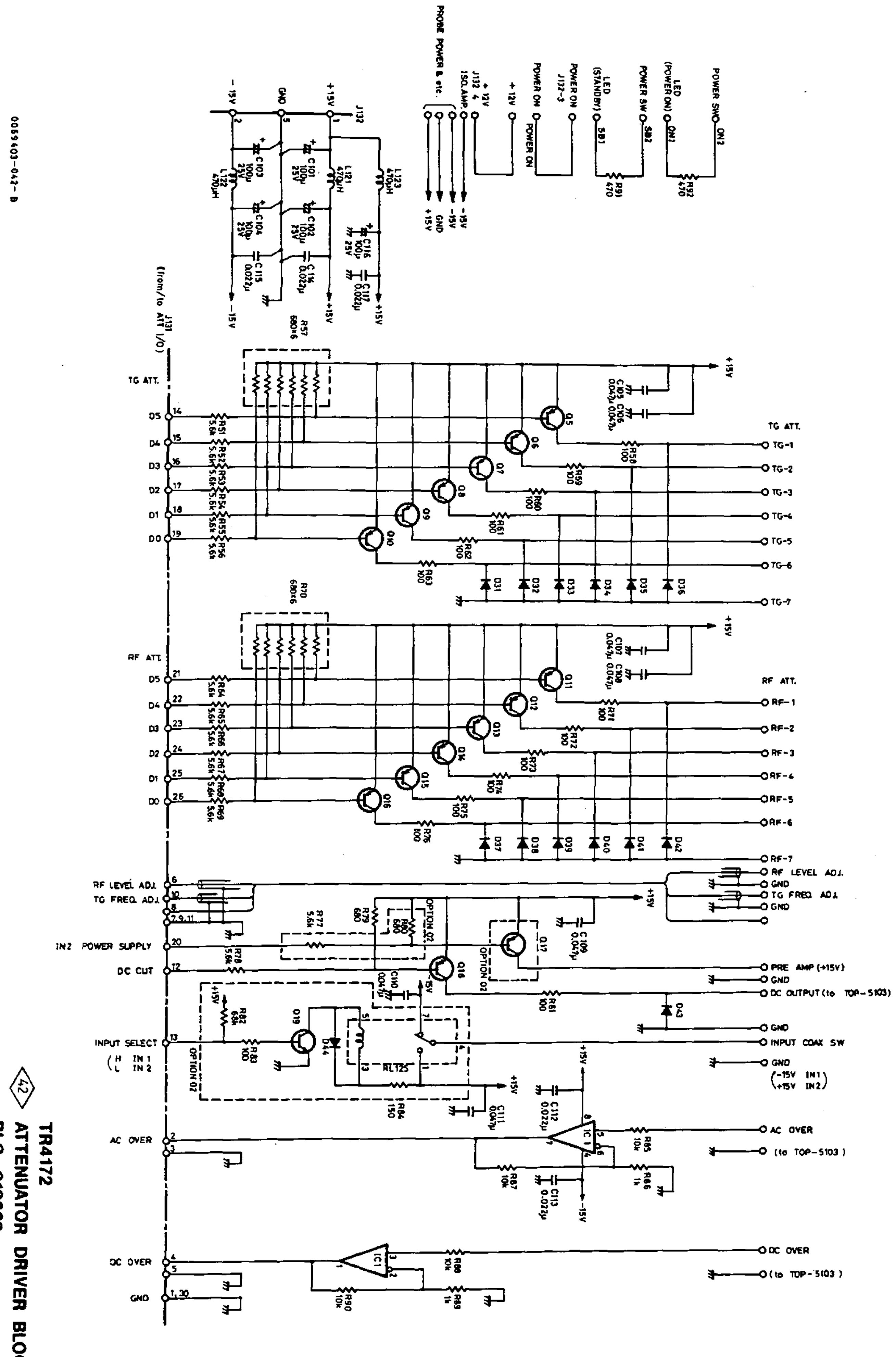
TR4172
RF KEY BLOCK(MEP-352)
BLN-010222



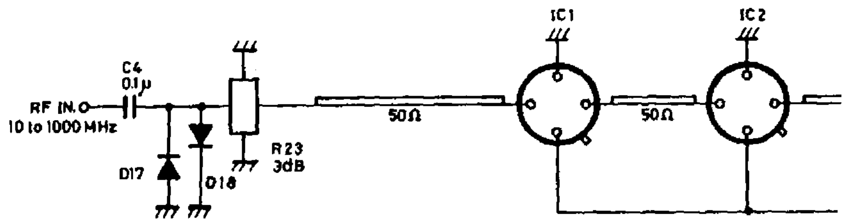
0069209 - 041 - A

41

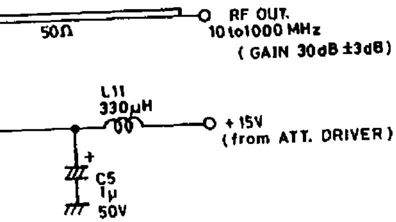
TR4172
SUB-PANEL BLOCK
MEP-340



TR4172
ATTENUATOR DRIVER BLOCK
BLC-010223

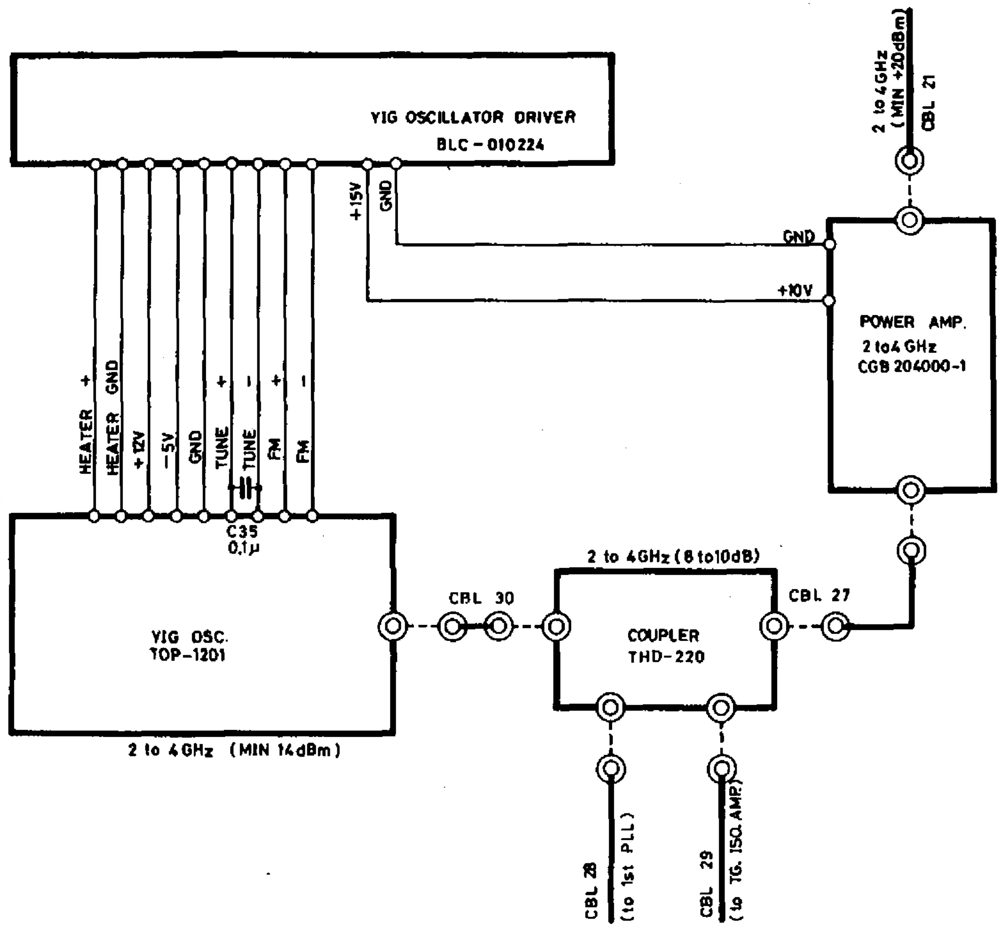


0069403-043- C



43

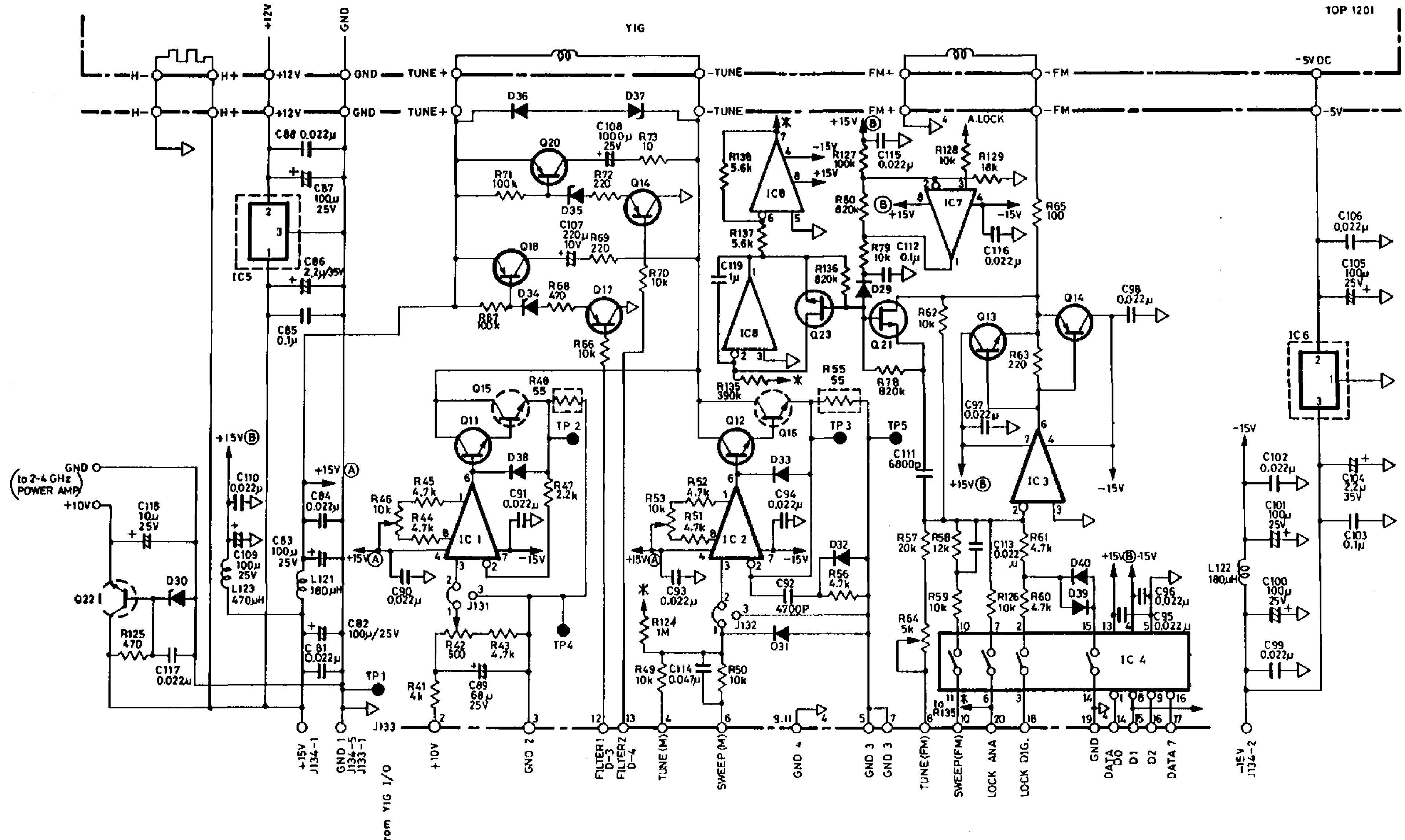
TR4172
PREAMPLIFIER
BLB-010233



0069303-044-C

44

TR4172
YIG OSCILLATOR BLOCK
MEP-341



R46	J131 PIN 2-3, TP2-TP4 0V ADJ.
R42	YIG OSC. 2046MHz ADJ.
R53	J132 PIN 2-3, TP3-TP5 0V ADJ.

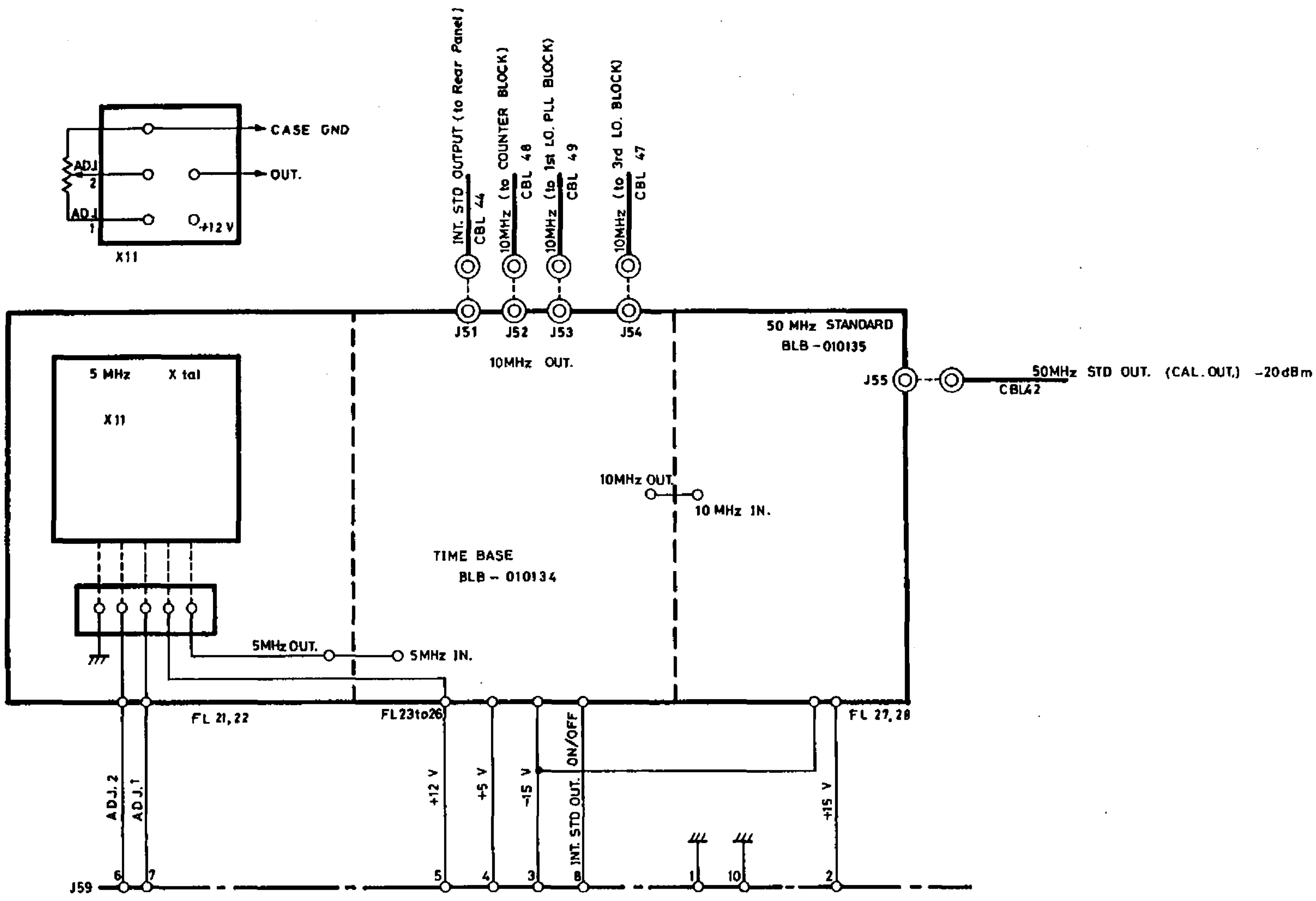
R64	FM TUNE GAIN ADJ.
R59	FM SWEEP GAIN ADJ.

0069404 - 045-E

TR4172

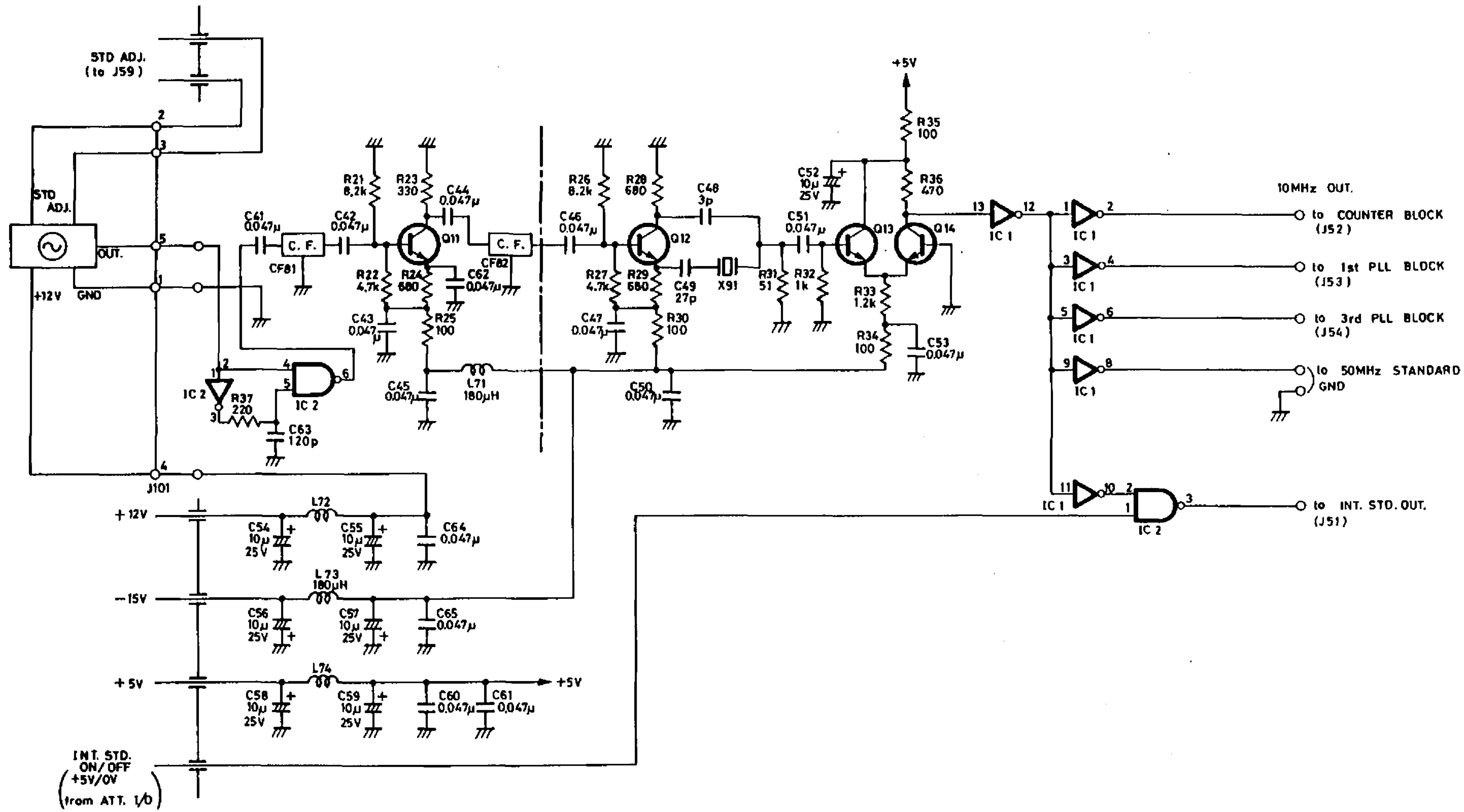
45 YIG OSCILLATOR DRIVER

BLC-010224



46

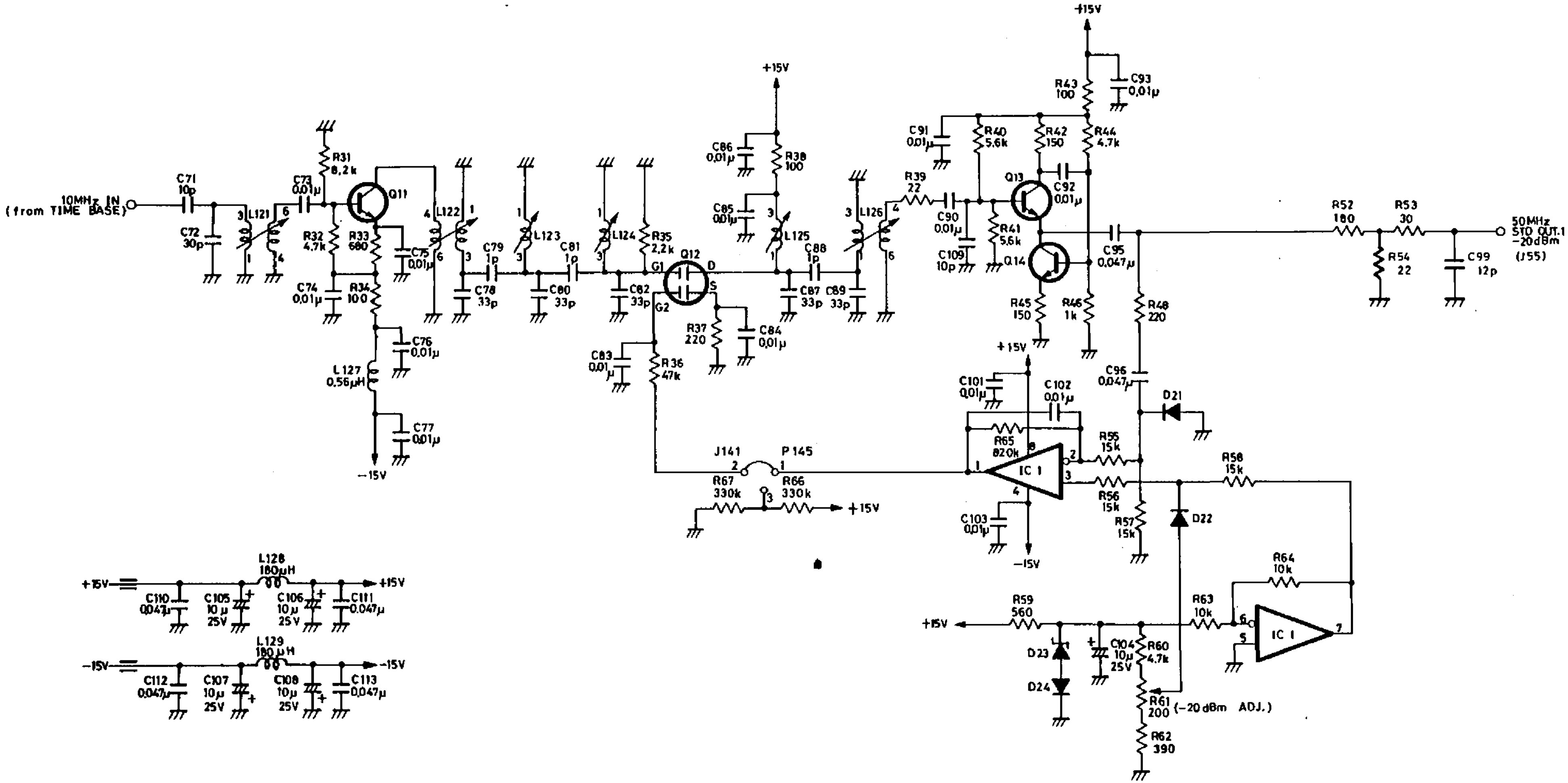
TR4172
STANDARD BLOCK
MEP-342



0069209 — 047-A

47

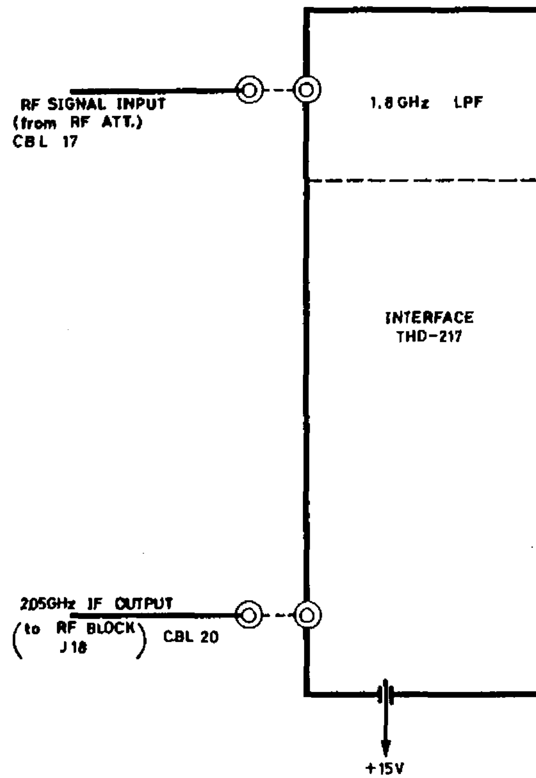
TR4172
TIME BASE
BLB—010134



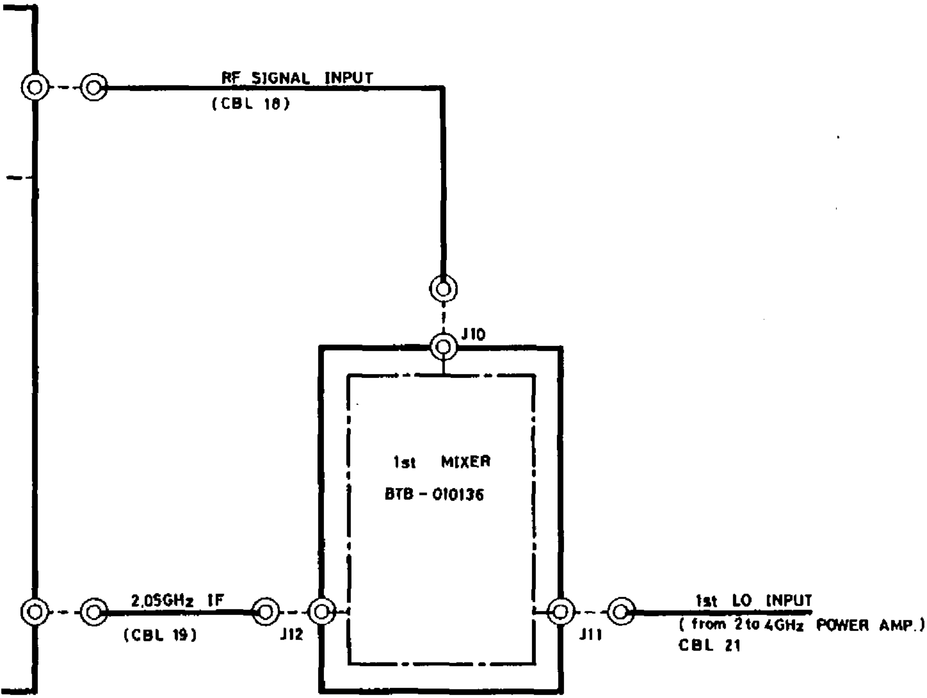
0069306-048-B

48

TR4172
50MHz STANDARD
BLB-010135

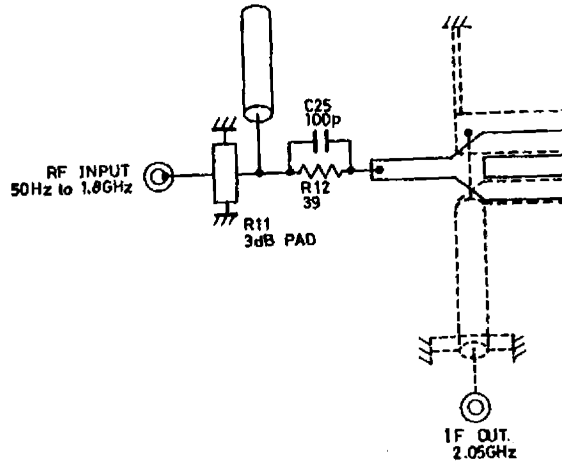


0069209-050-A

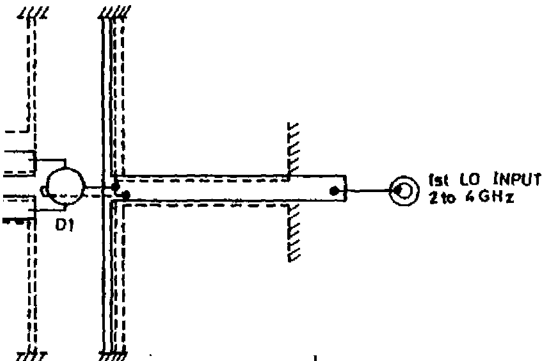


50

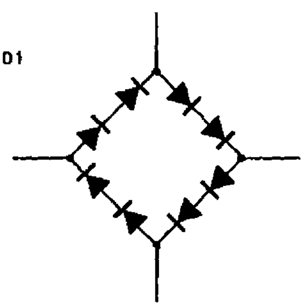
TR4172
1st MIXER BLOCK
MEP-343



0069209-051-A

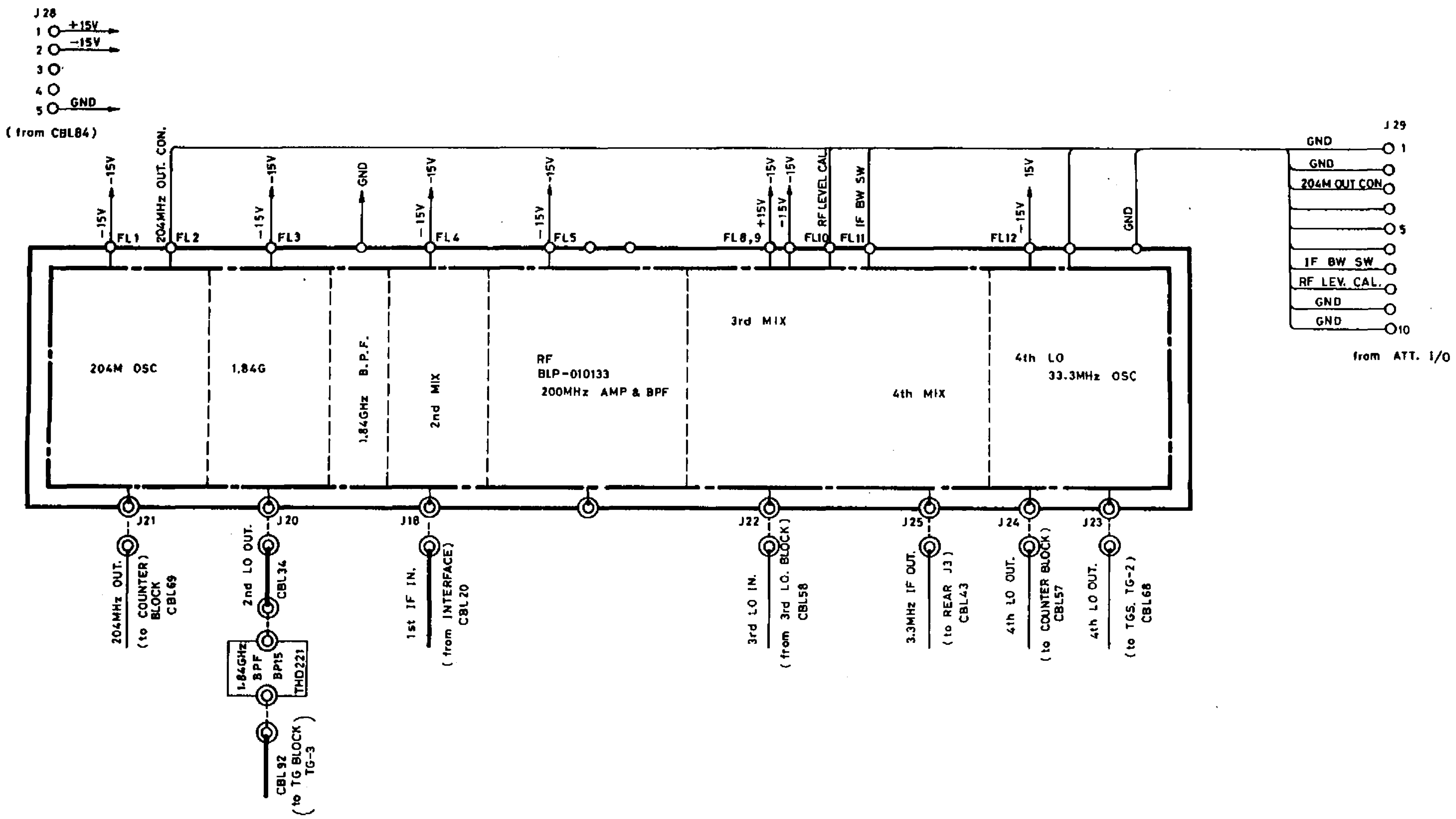


D1



51

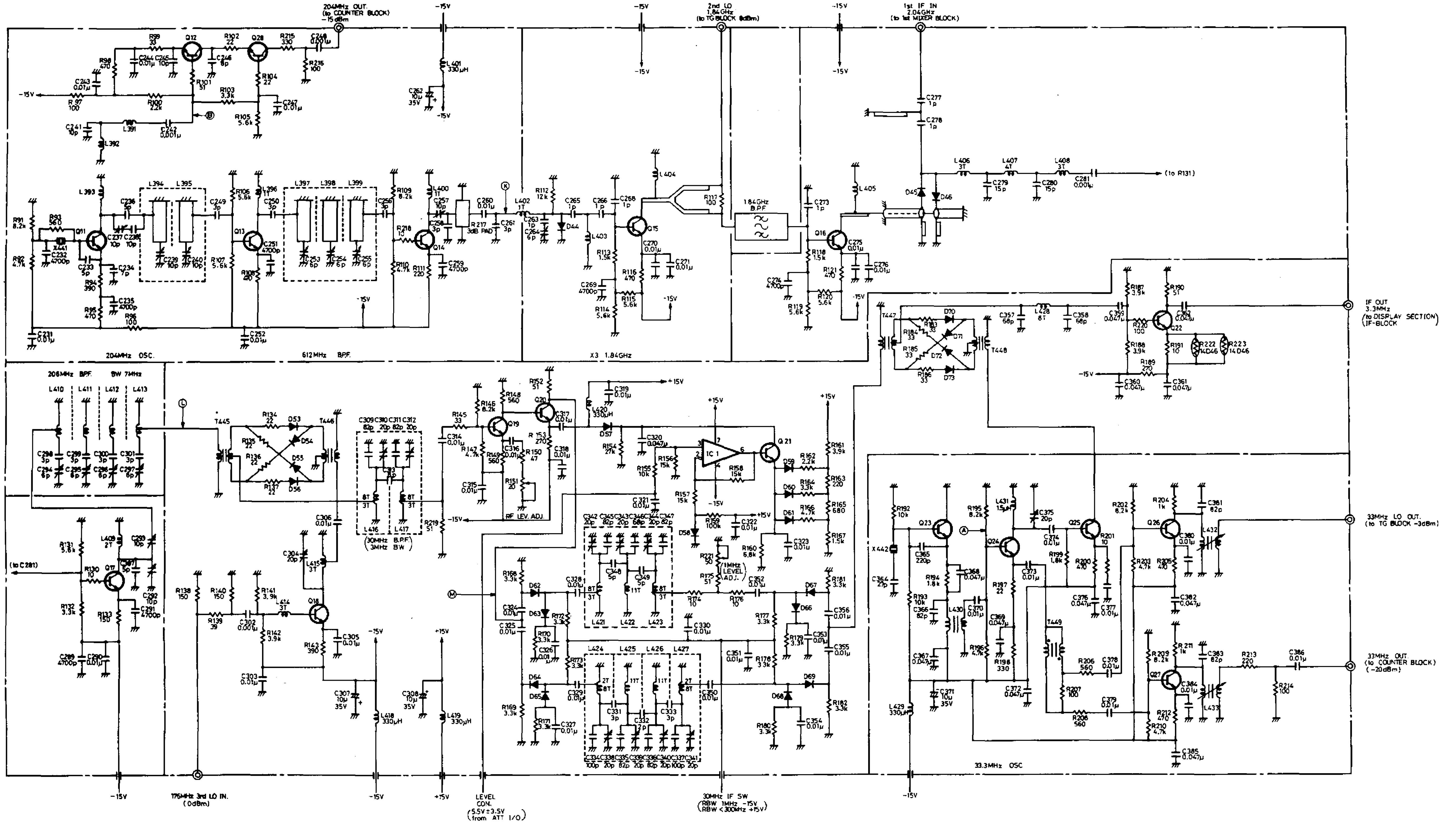
TR4172
1st MIXER
BTB−010136



0069209-052-B

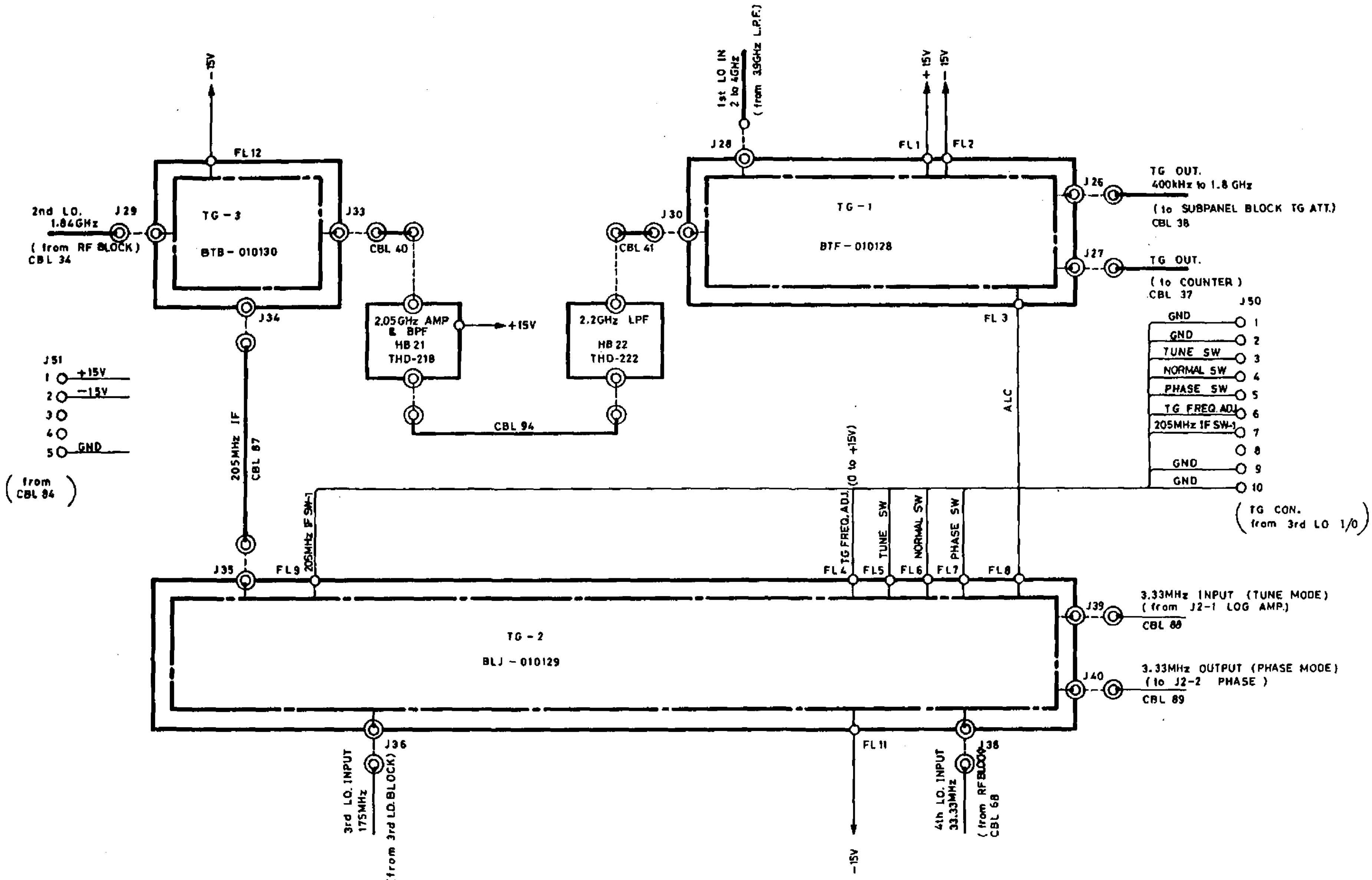
52

TR4172/73
RF BLOCK
MEP-345



0069305-053-C

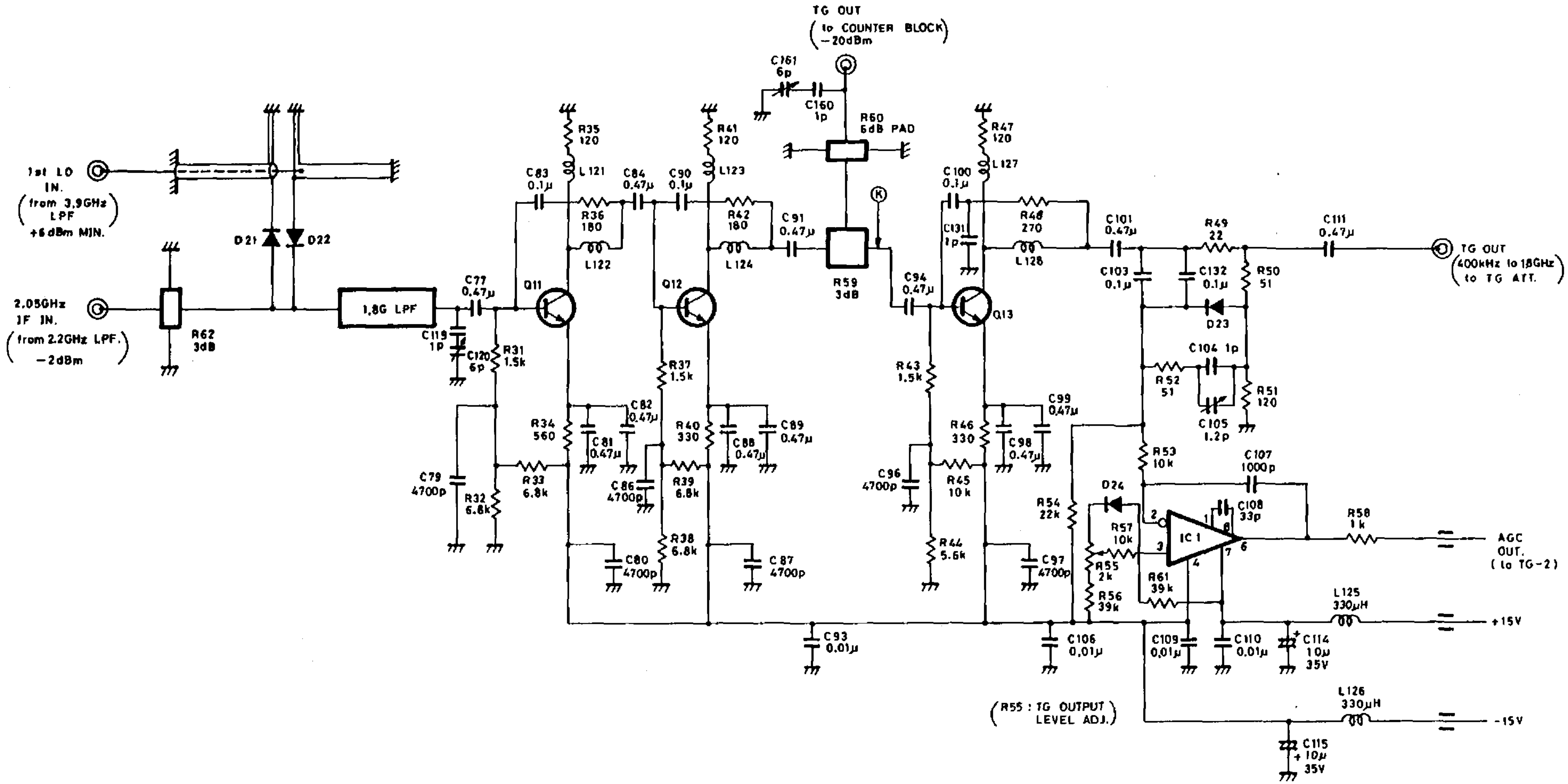
TR4172
53 RF
BLP-010133



0069301 – 054 – B

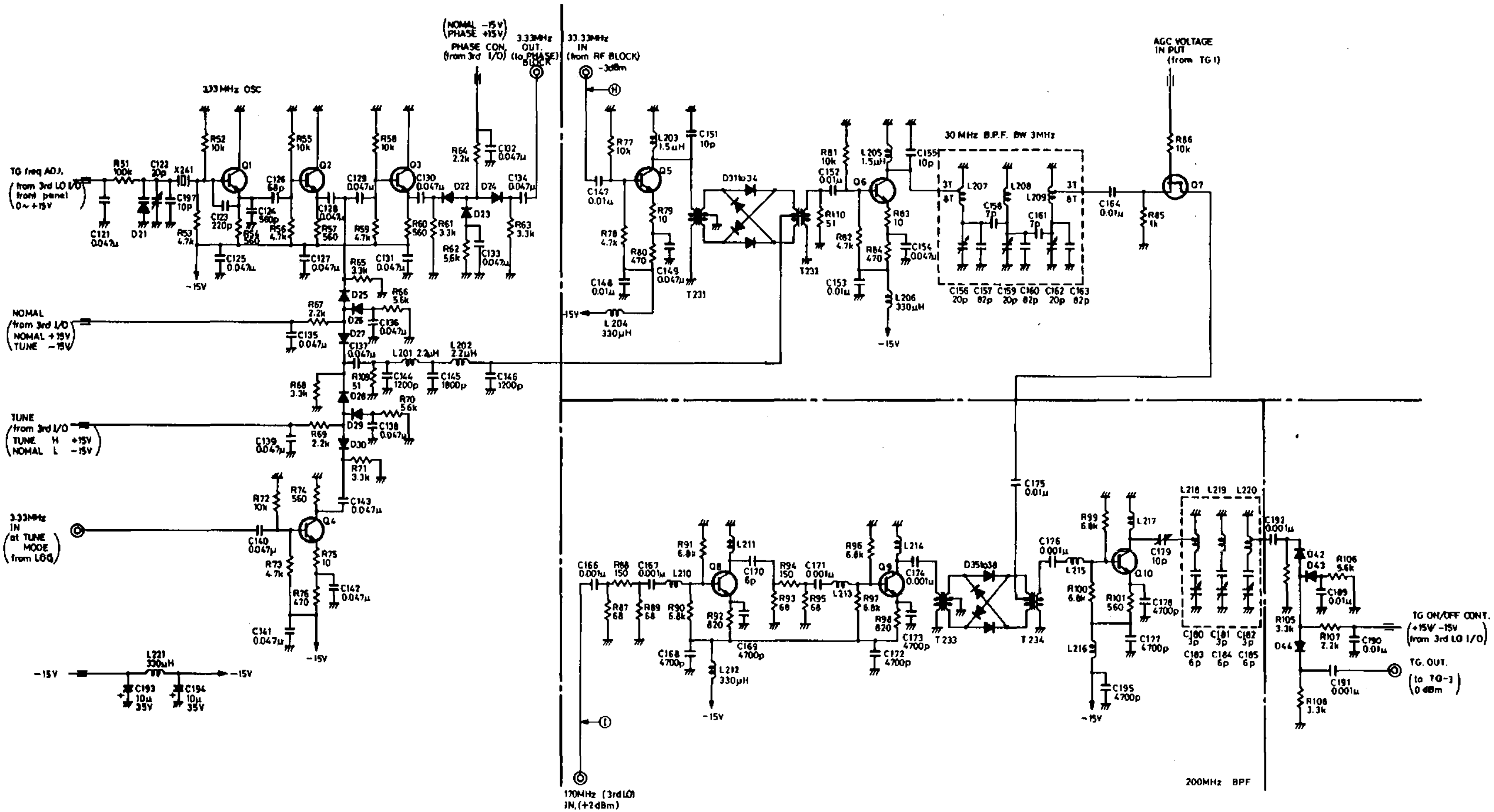
54

TR4172/73
TRACKING GENERATOR BLOCK
MEP–346



0069405-055 – C

55 TR4172
TRACKING GENERATOR – 1
BTF – 010128

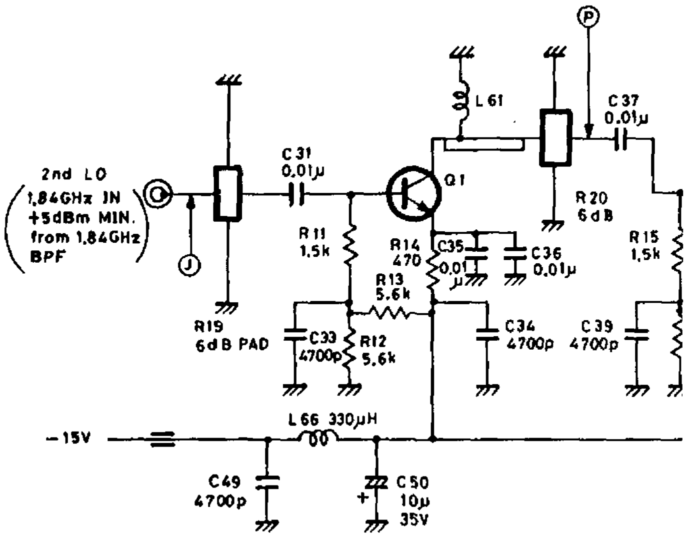


0068306-058-B

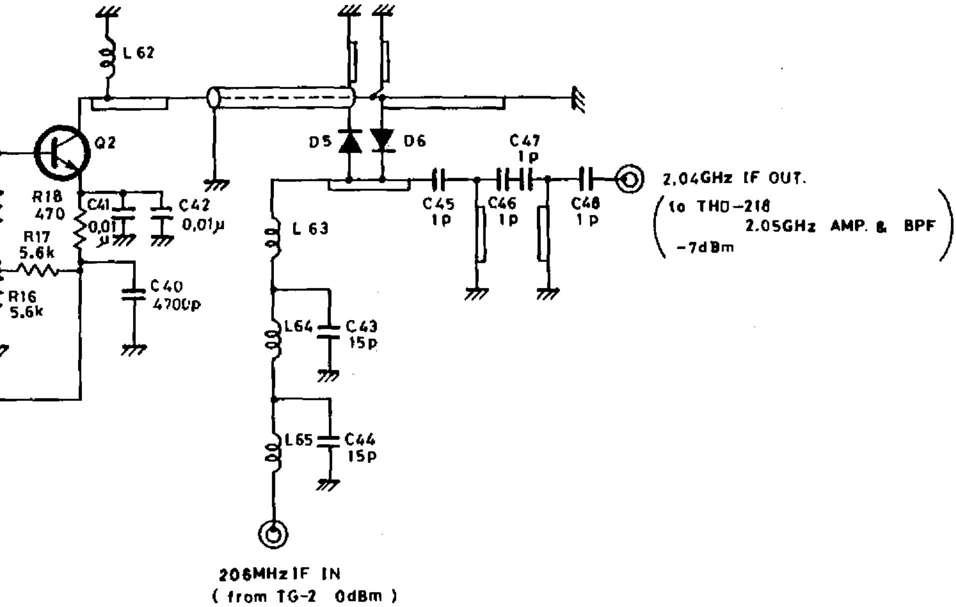
TR4172

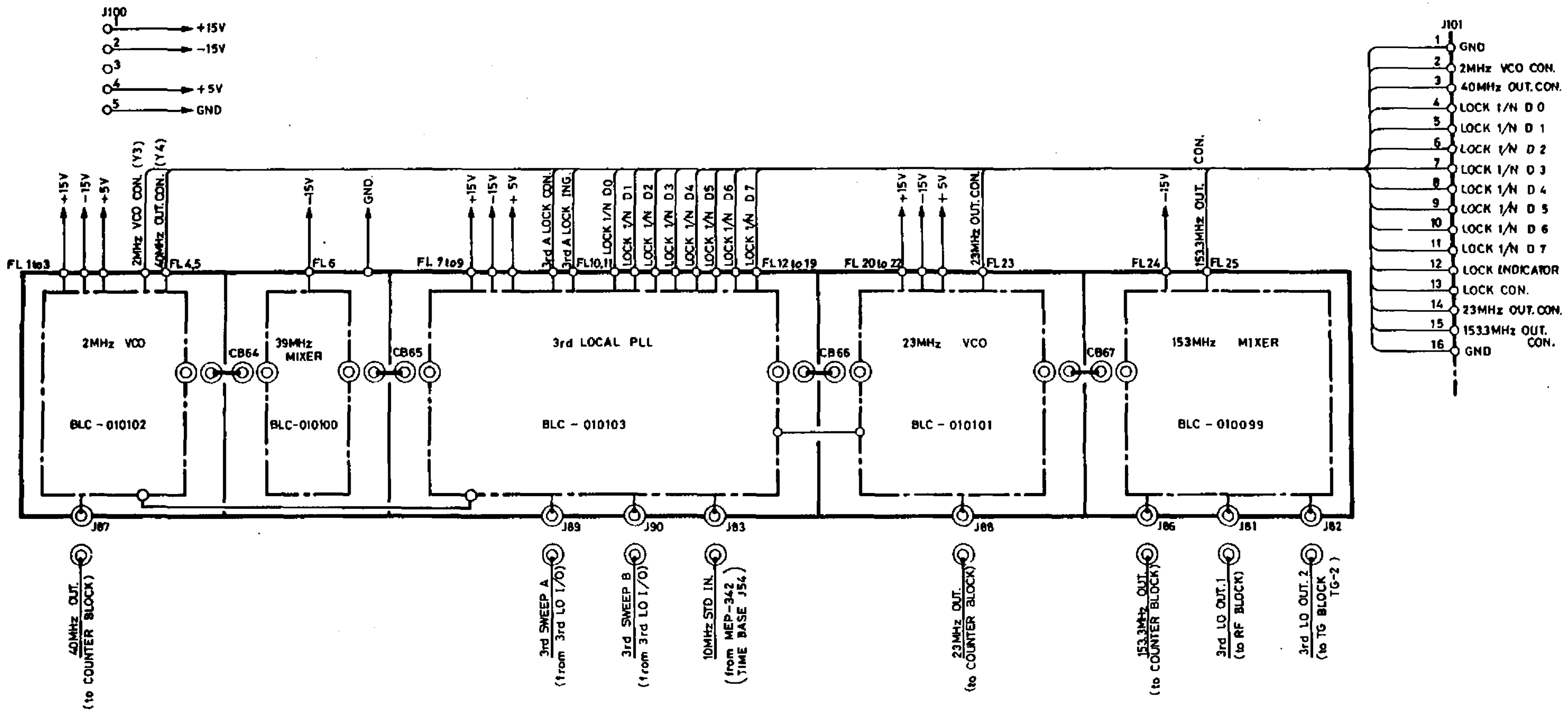
56 **TRACKING GENERATOR—2**

BLJ—010129



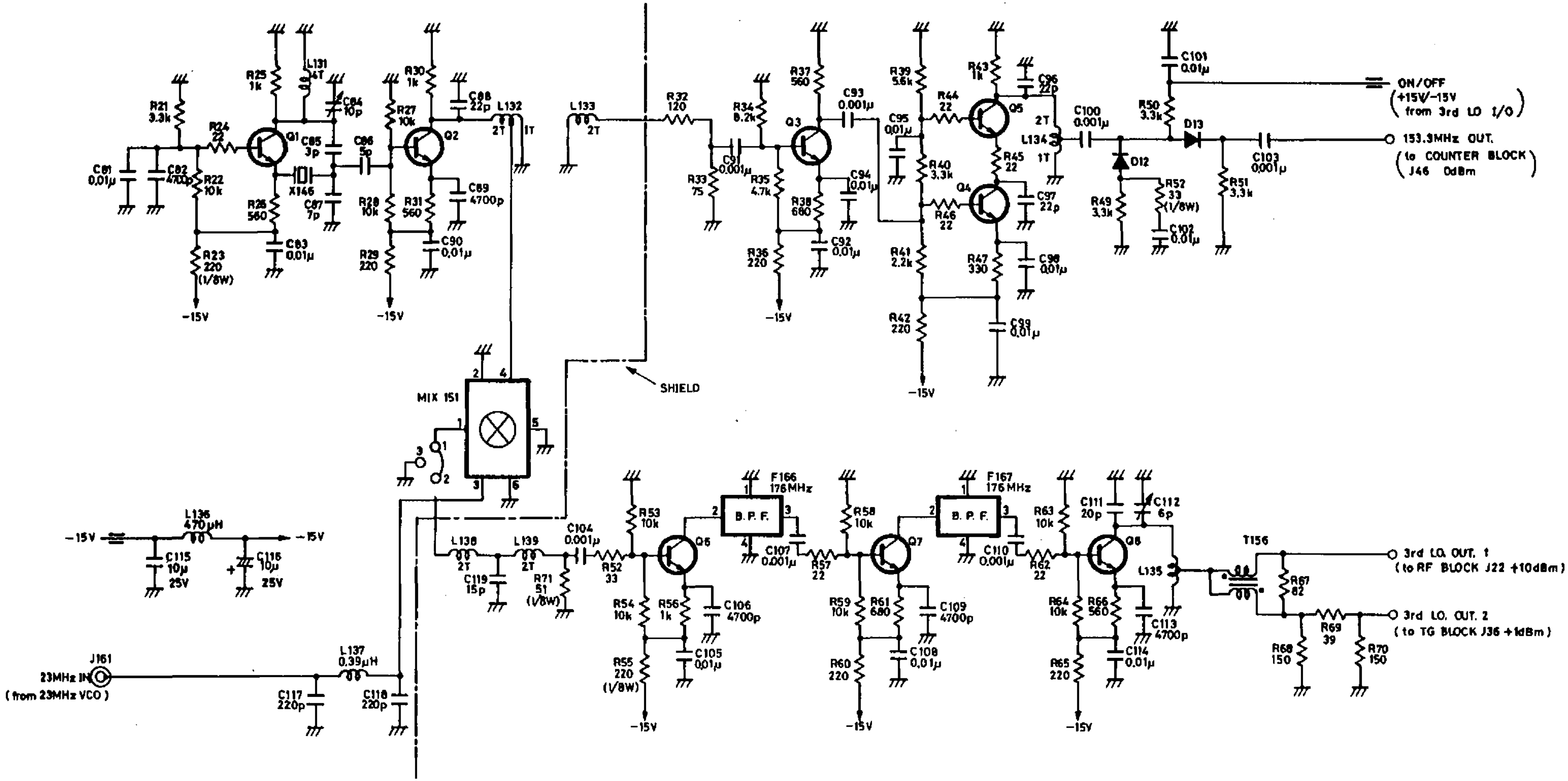
0069305 -057-C


L 62
Q2
R18
470
C41
0.01
μ
C42
0.01μ
R17
5.6k
R16
5.6k
C40
4700p
D5
D6
C47
1p
C45
1p
C46
1p
C48
1p
2.04GHz IF OUT.
(to THD-218
2.05GHz AMP. & BPF
-7dBm)
L 63
L64
C43
15p
L65
C44
15p
206MHz IF IN
(from TG-2 0dBm)



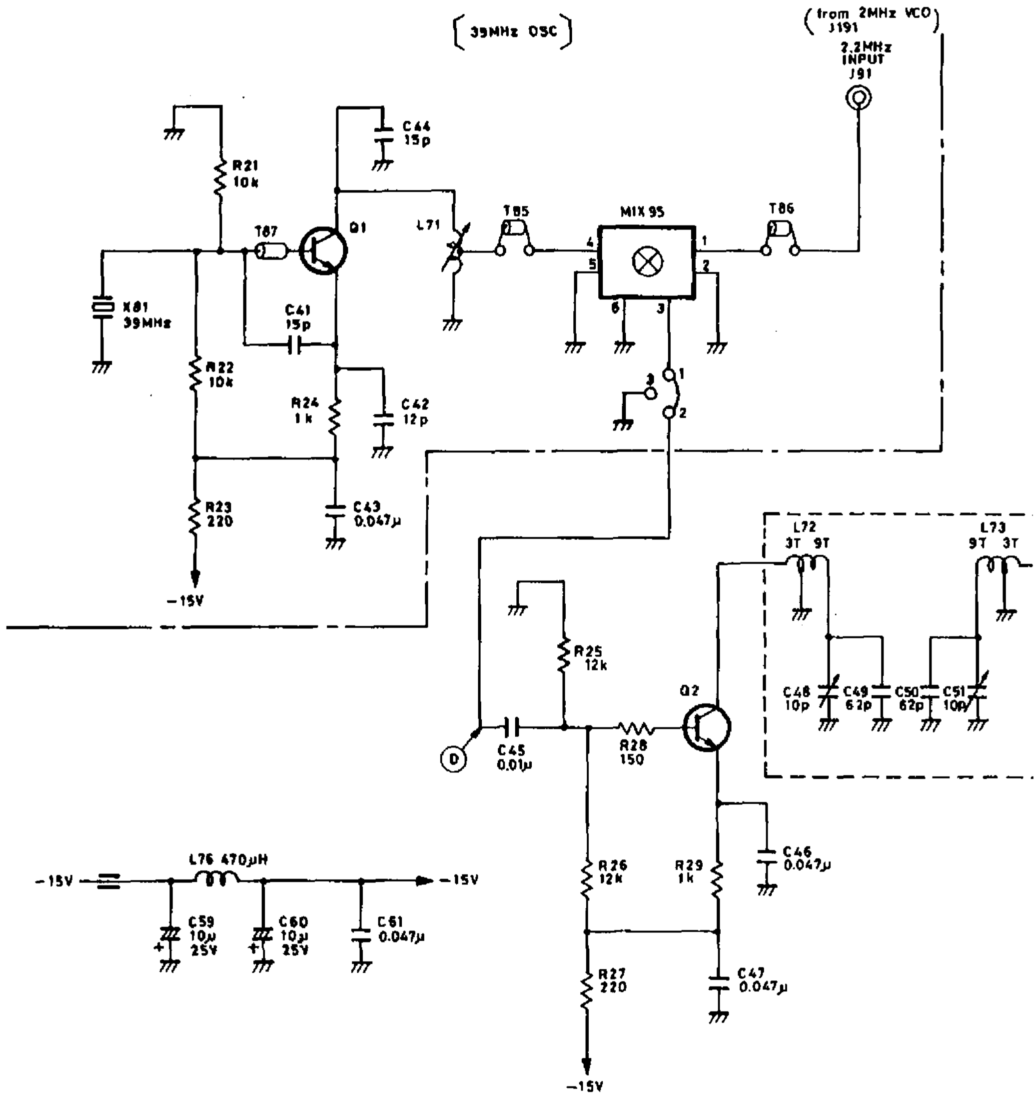
0069209 - 058-8

58 TR4172
3rd LOCAL BLOCK
MEP-347

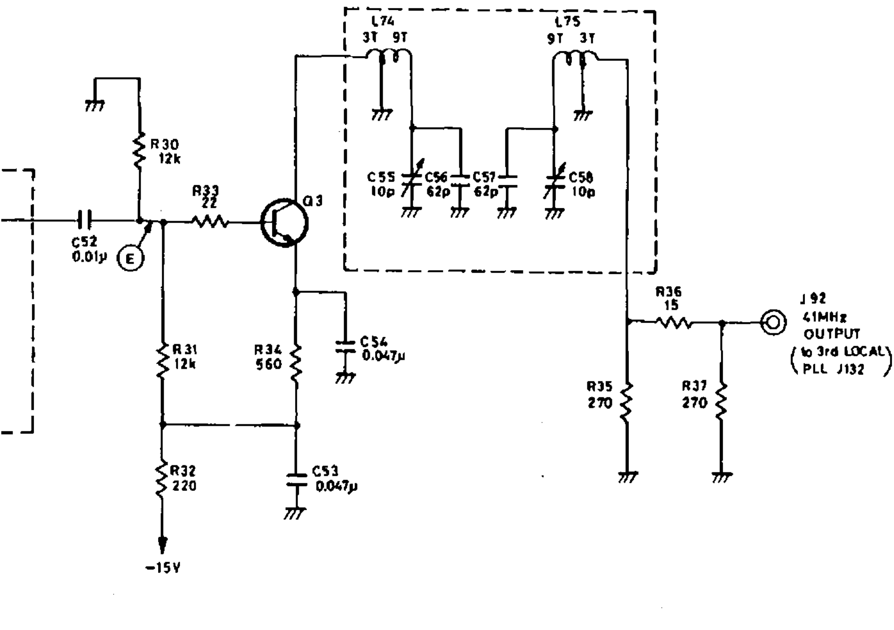


0069311 - 059 - D

59 TR4172
153MHz MIXER
BLC-010099

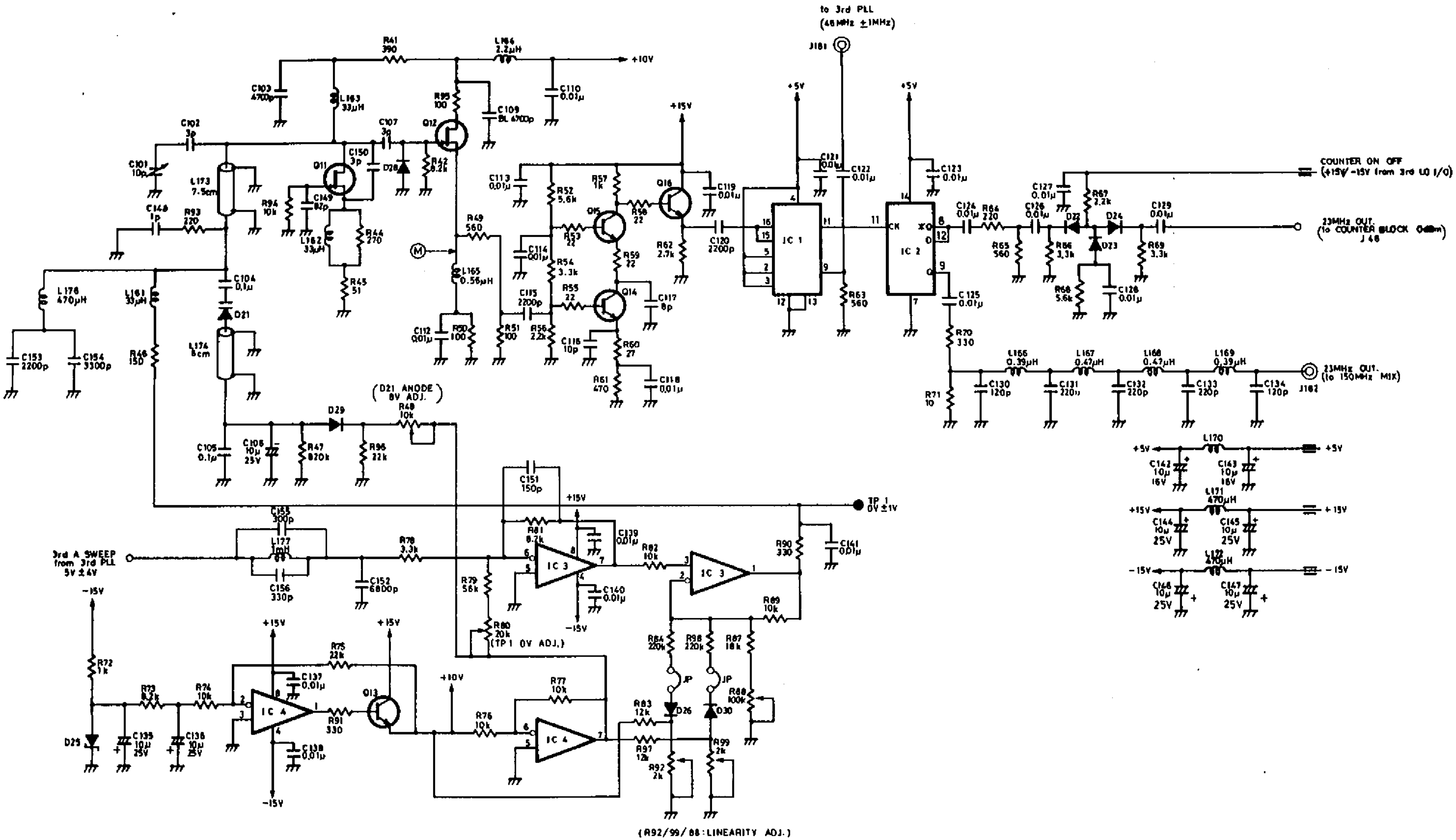


0069405—060—D



60

TR4172
39MHz MIXER
BLC-010100

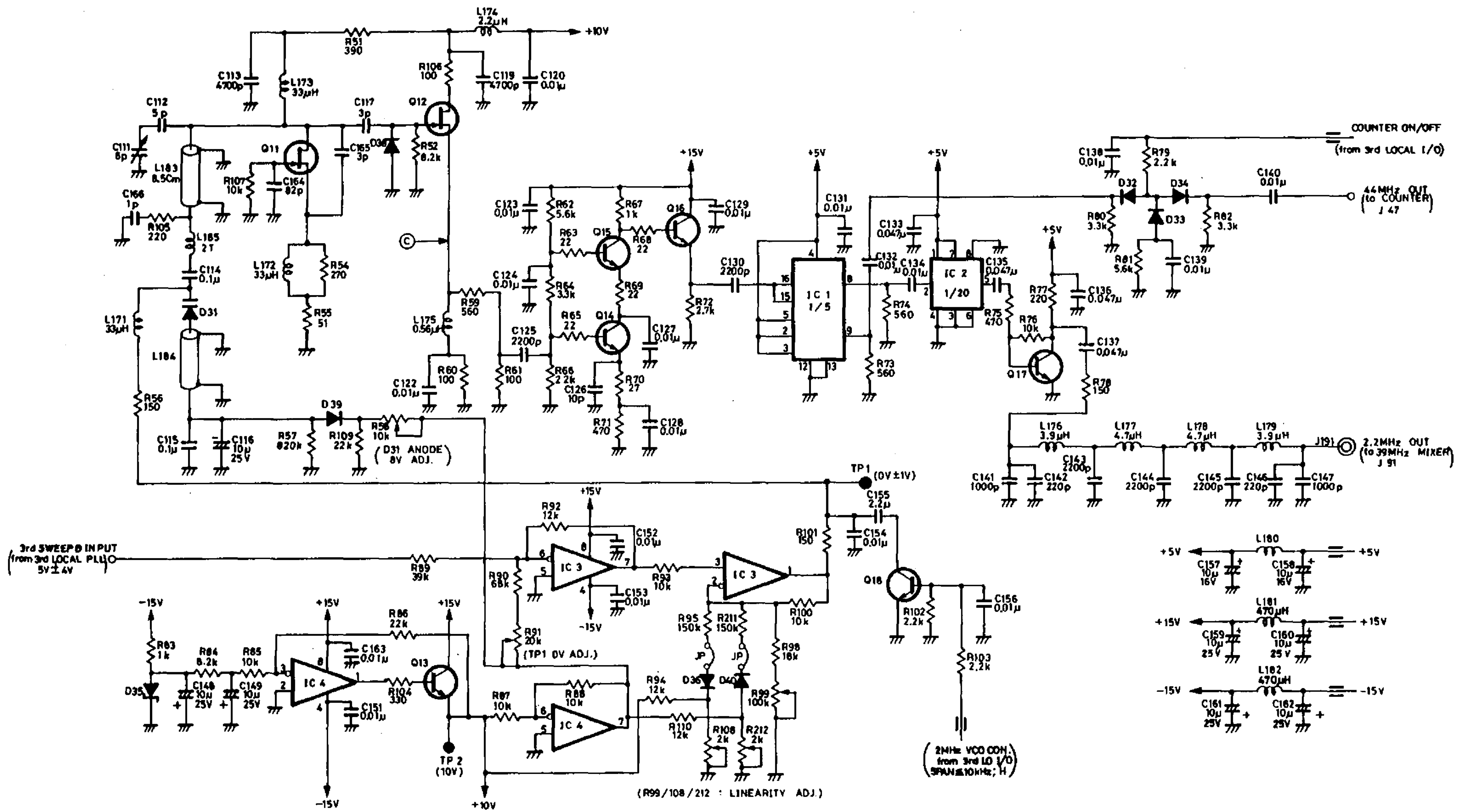


TR4172

61 **23MHz VCO**

BLC–010101

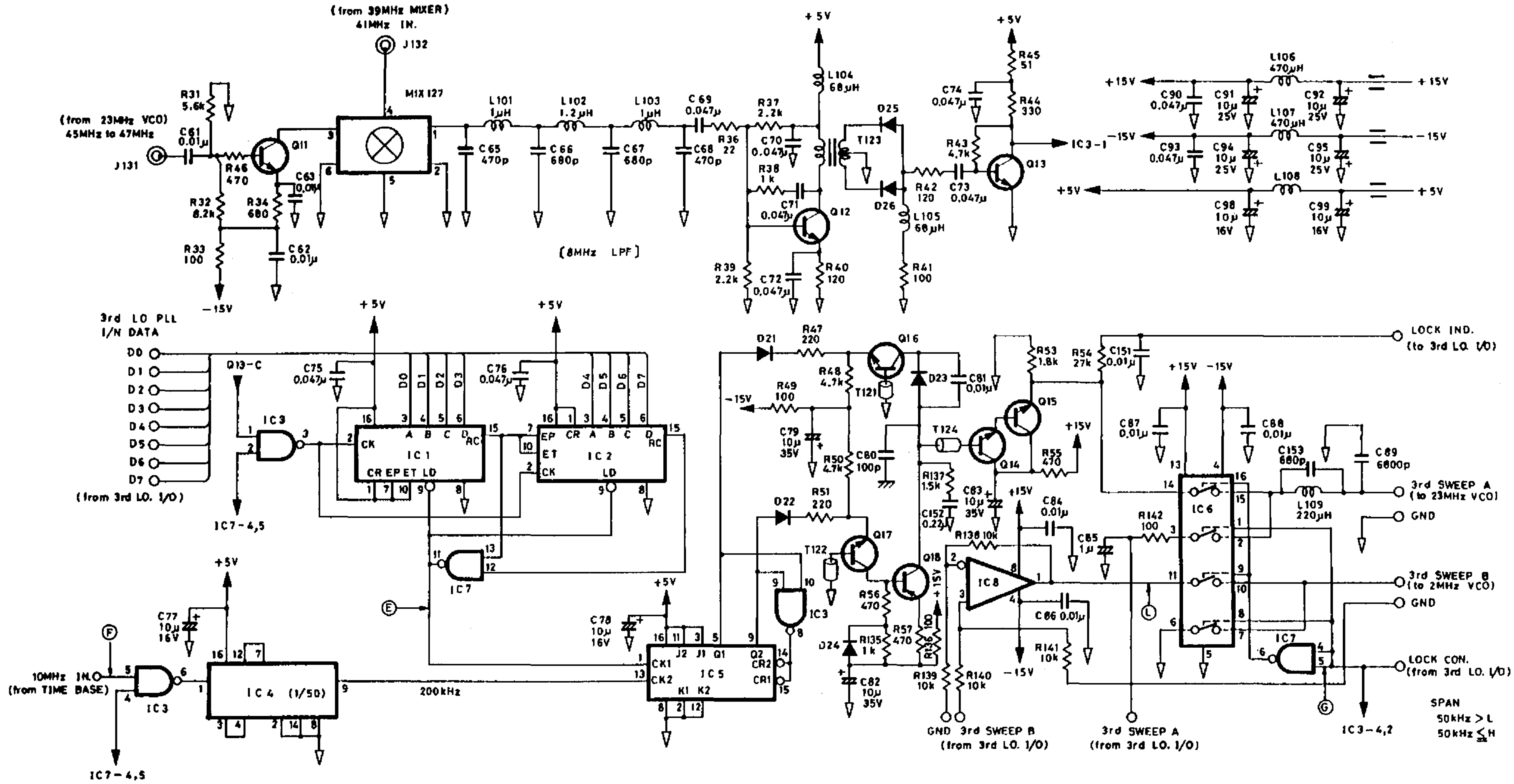
0069310-061-C



0069411-062-D

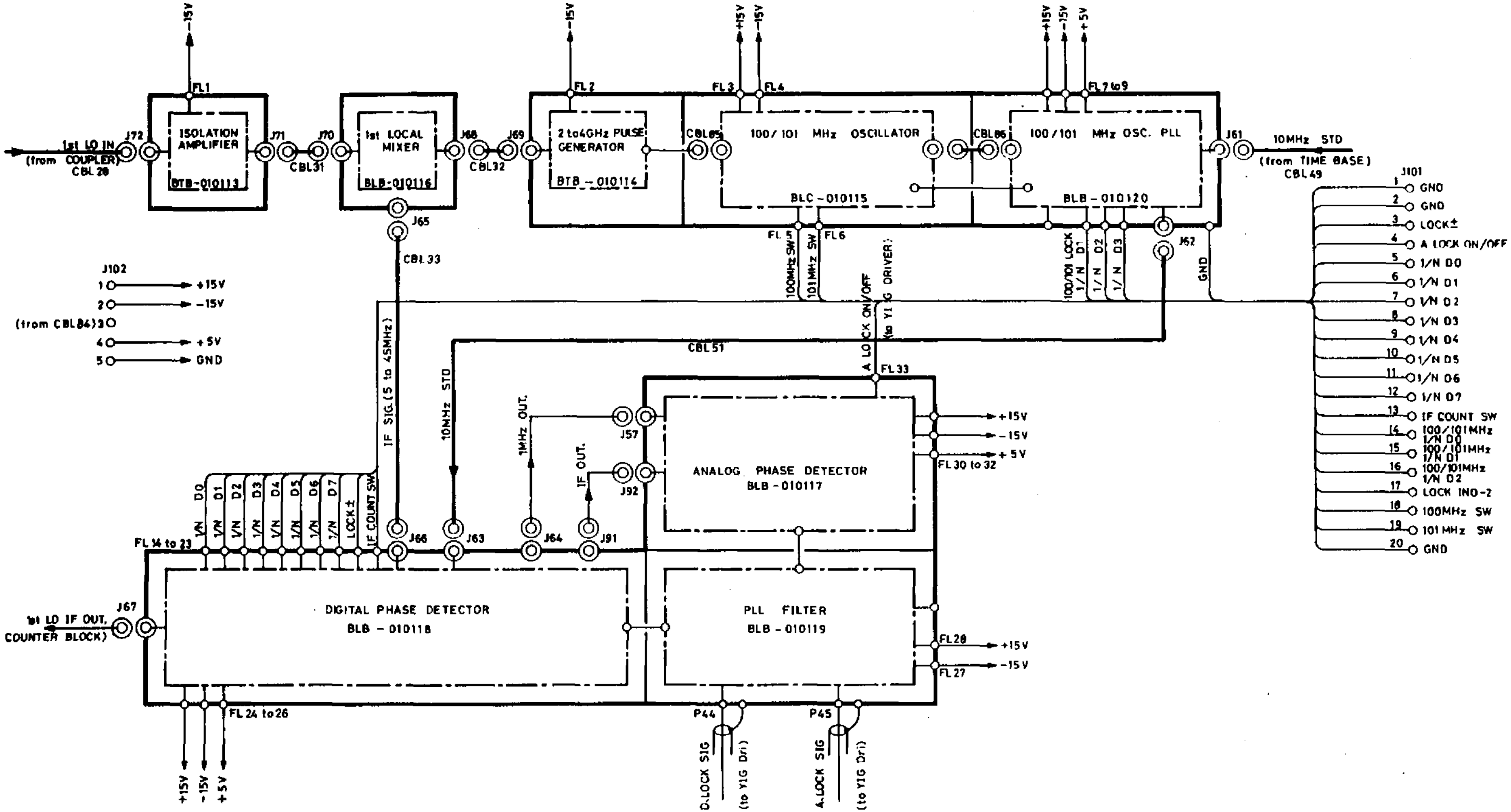
62

TR4172
2MHz VCO
BLC-010102



0069407-063-D

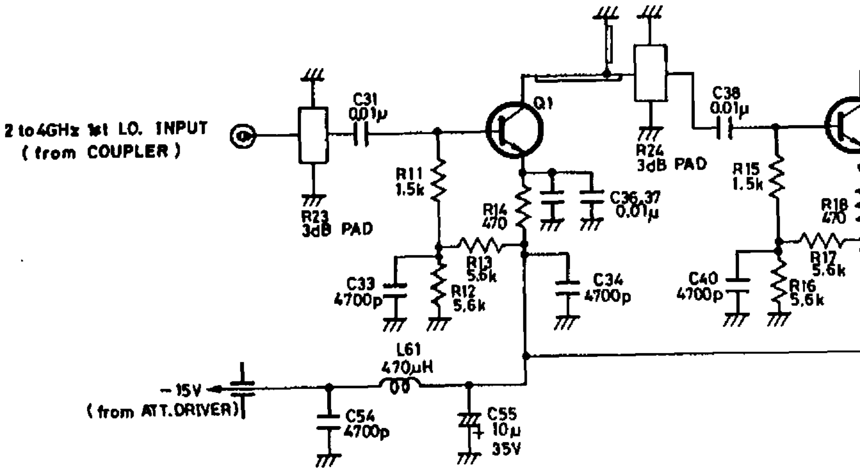
TR4172
63 3rd LOCAL PLL
BLC-010103



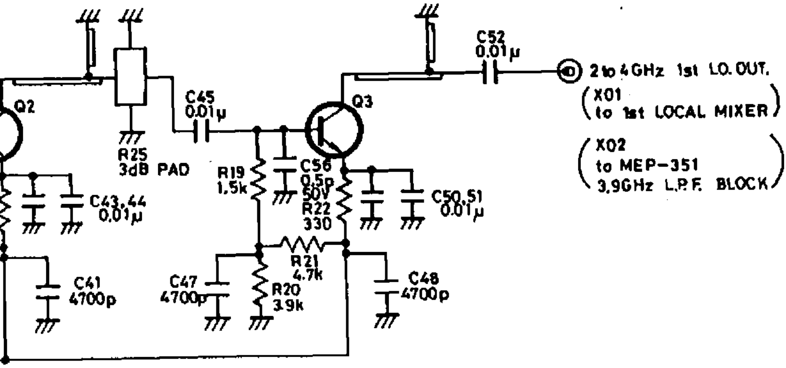
0069409-064-D

64

TR4172
1st LOCAL PLL BLOCK
MEP-348

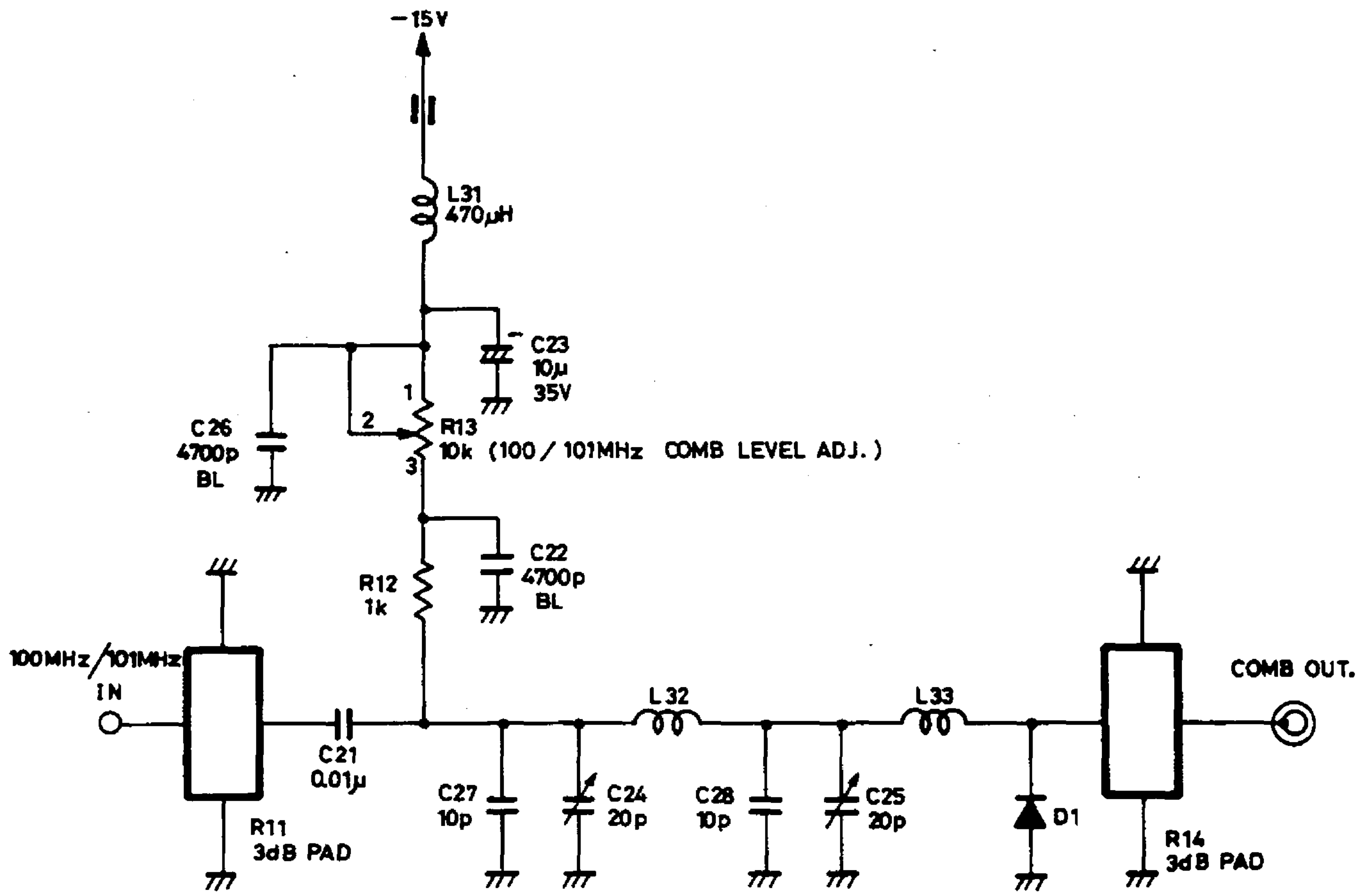


0069311 −065− D



65

TR4172
ISOLATION AMPLIFIER
BTB–010113×01/02



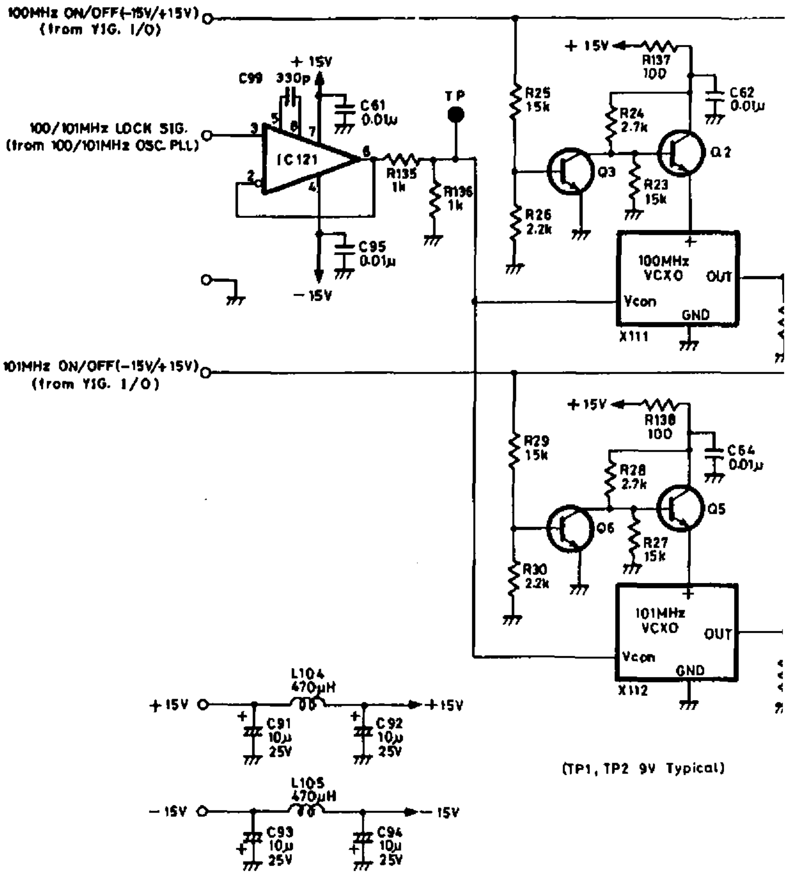
0069305-066-B

66

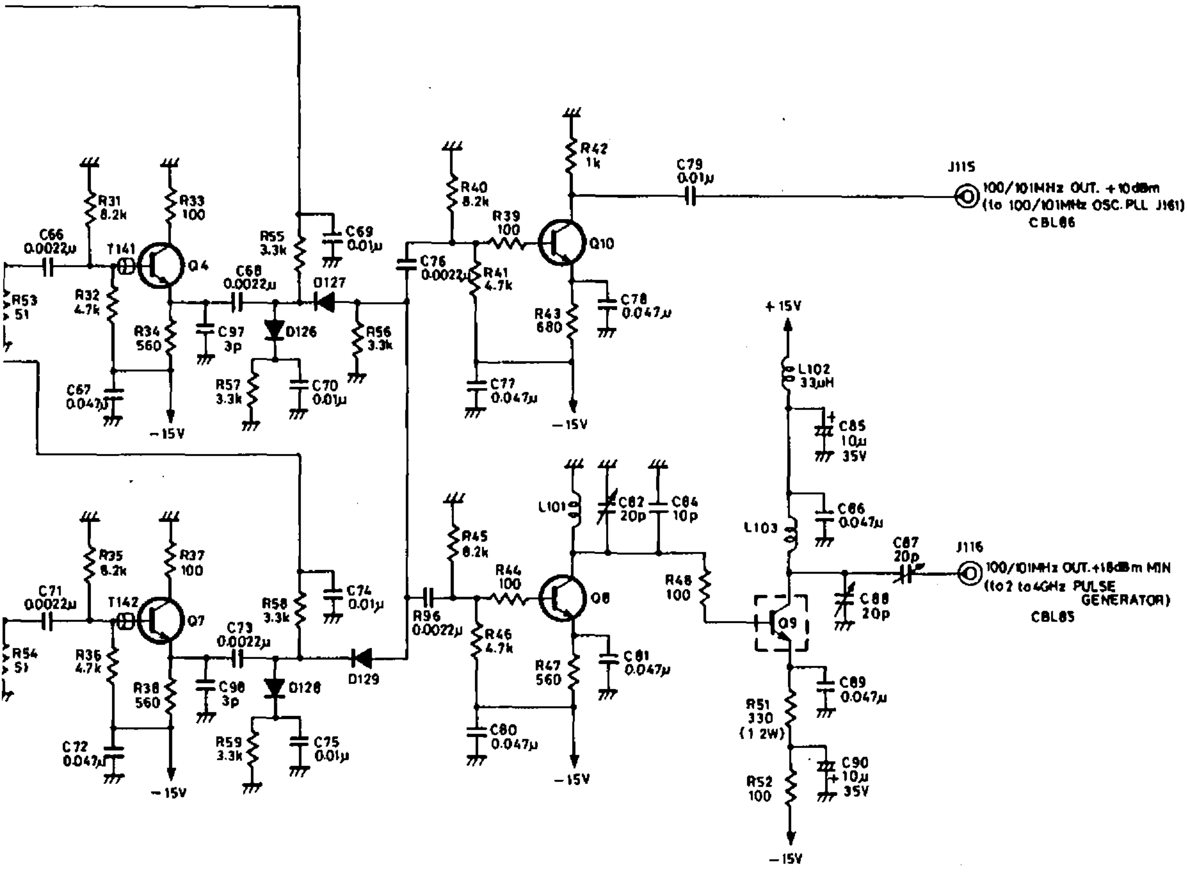
TR4172

2-4GHz PULSE GENERATOR

BTB-010114



0069404- 067-E

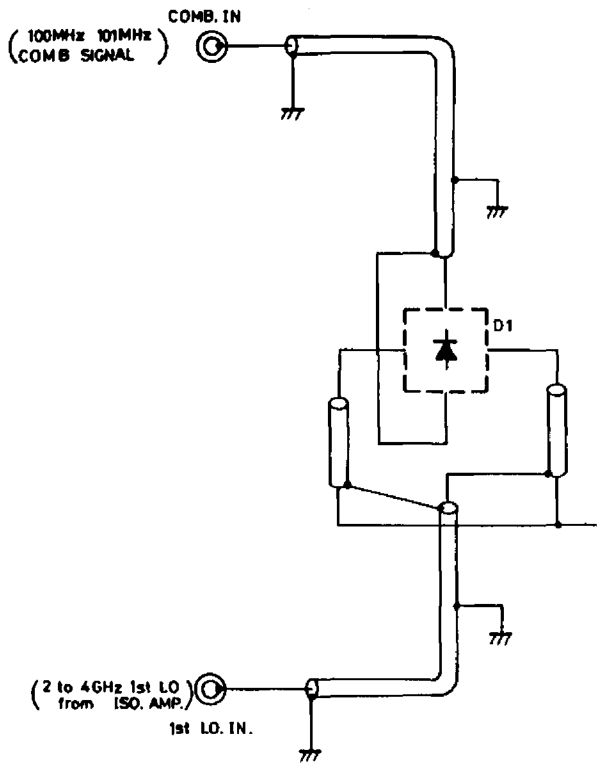


TR4172

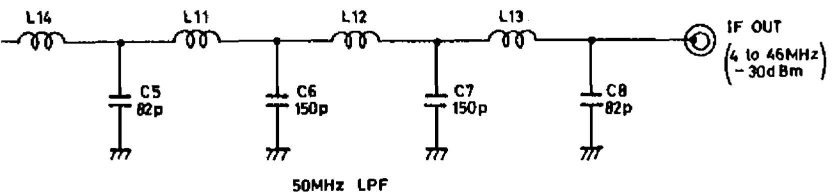
67

100/101MHz OSCILLATOR

BLC-010115

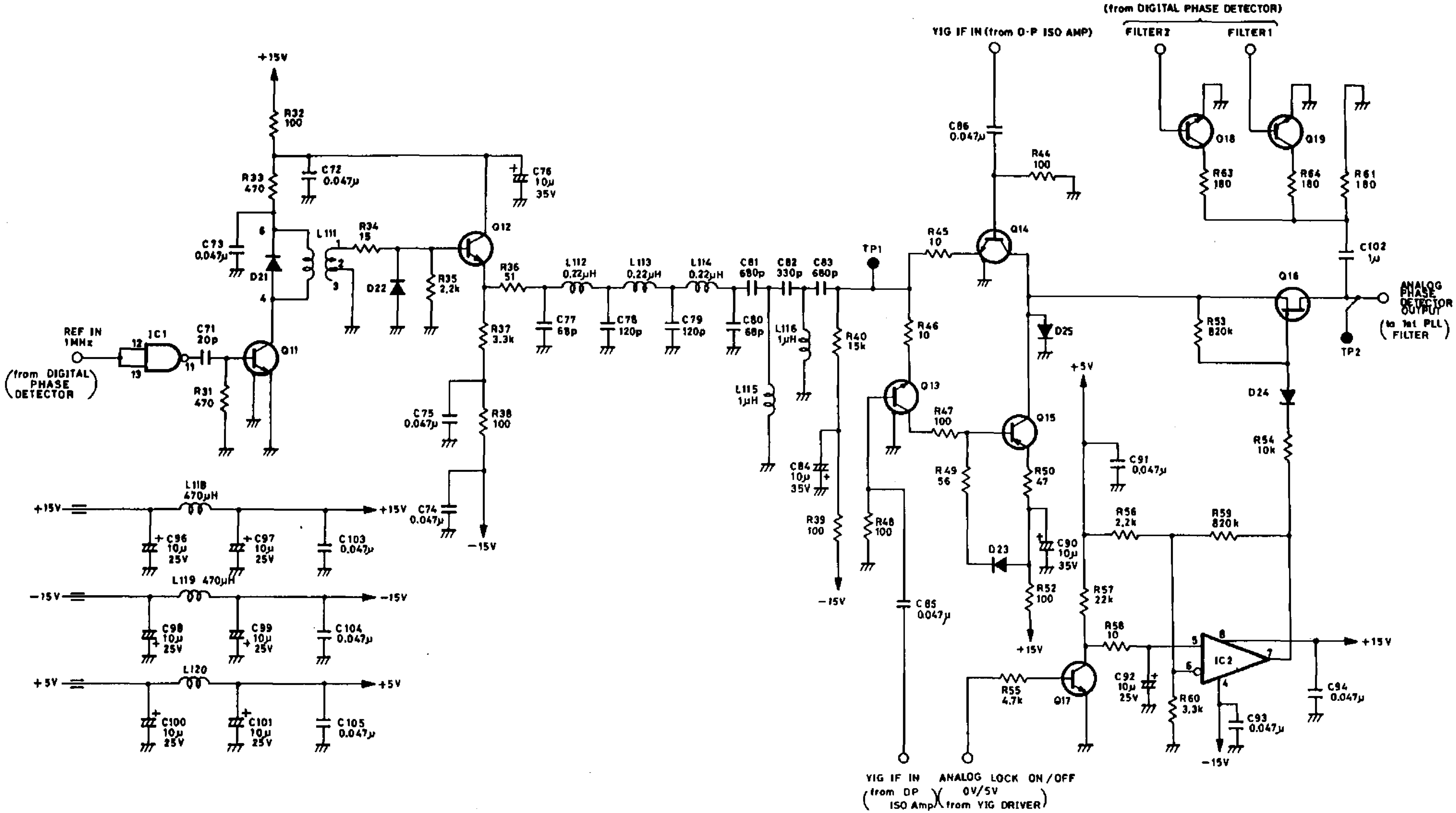


0069209 —068-A



68

TR4172
1st LOCAL MIXER
BLB-010116



NOTE

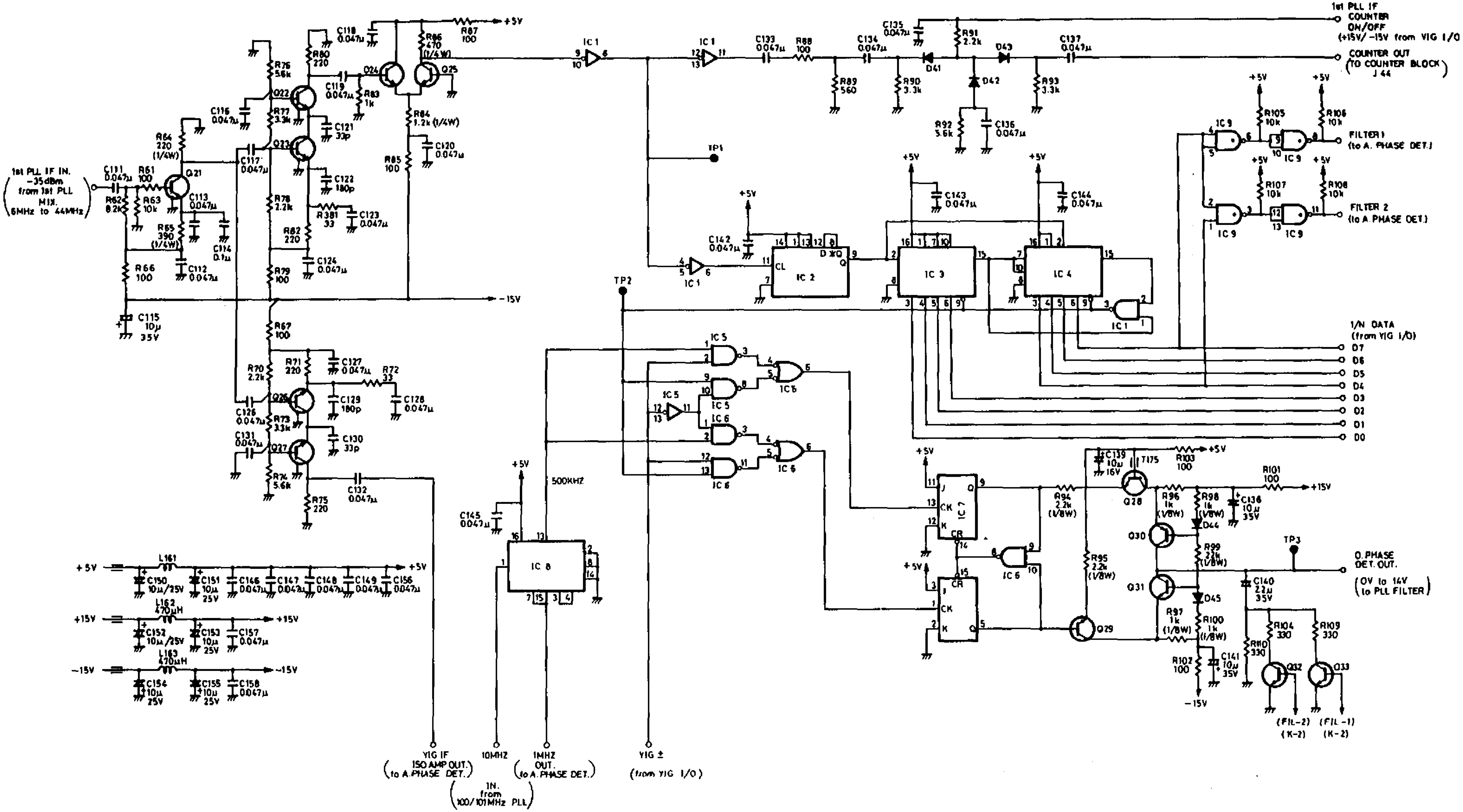
Unless otherwise noted, resistors are of 1/8W carbon type

0069311-069-D

TR4172

⟨69⟩ ANALOG PHASE DETECTOR

BLB-010117



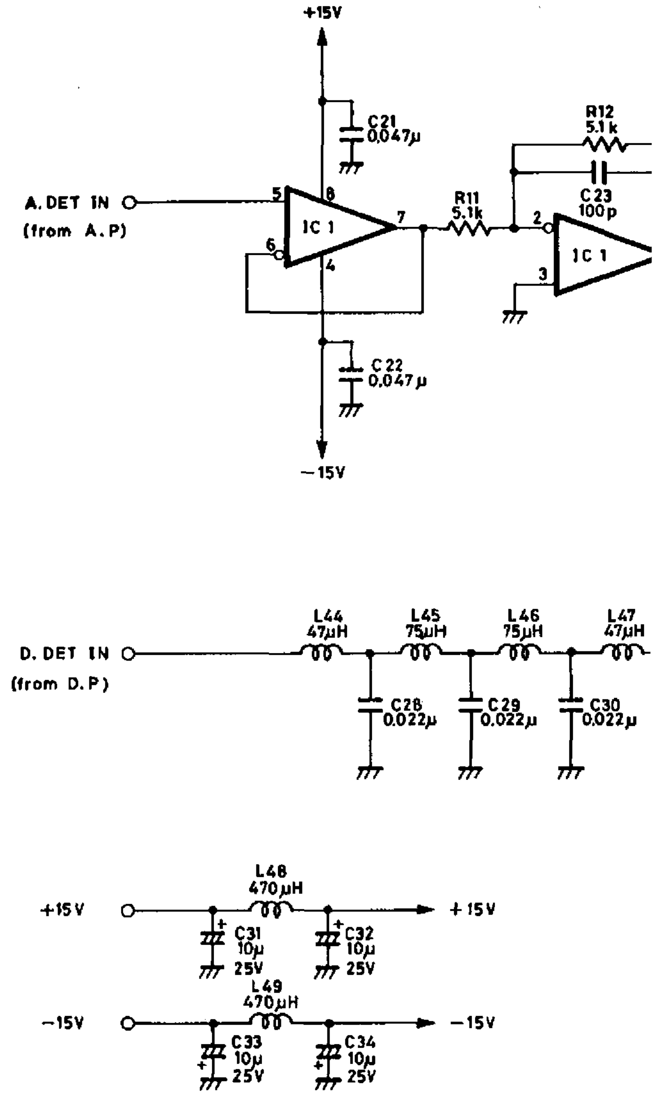
NOTE:
Unless otherwise noted, resistors of 1/8W carbon type
A. PHASE DET : ANALOG PHASE DETECTOR
D. PHASE DET : DIGITAL PHASE DETECTOR

0069311 -070- D

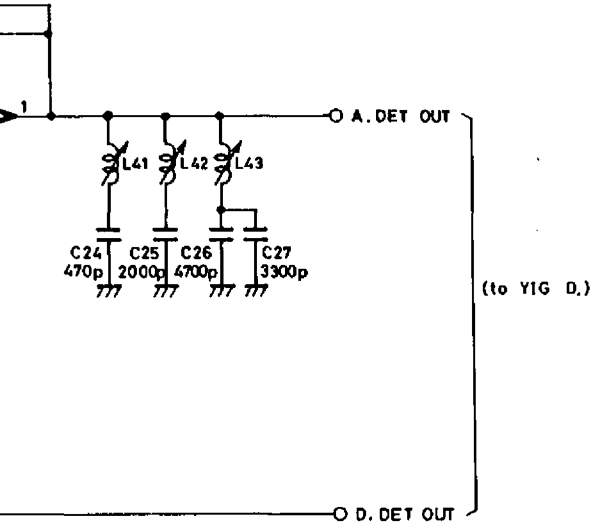
TR4172

70 DIGITAL PHASE DETECTOR

BLB—010118

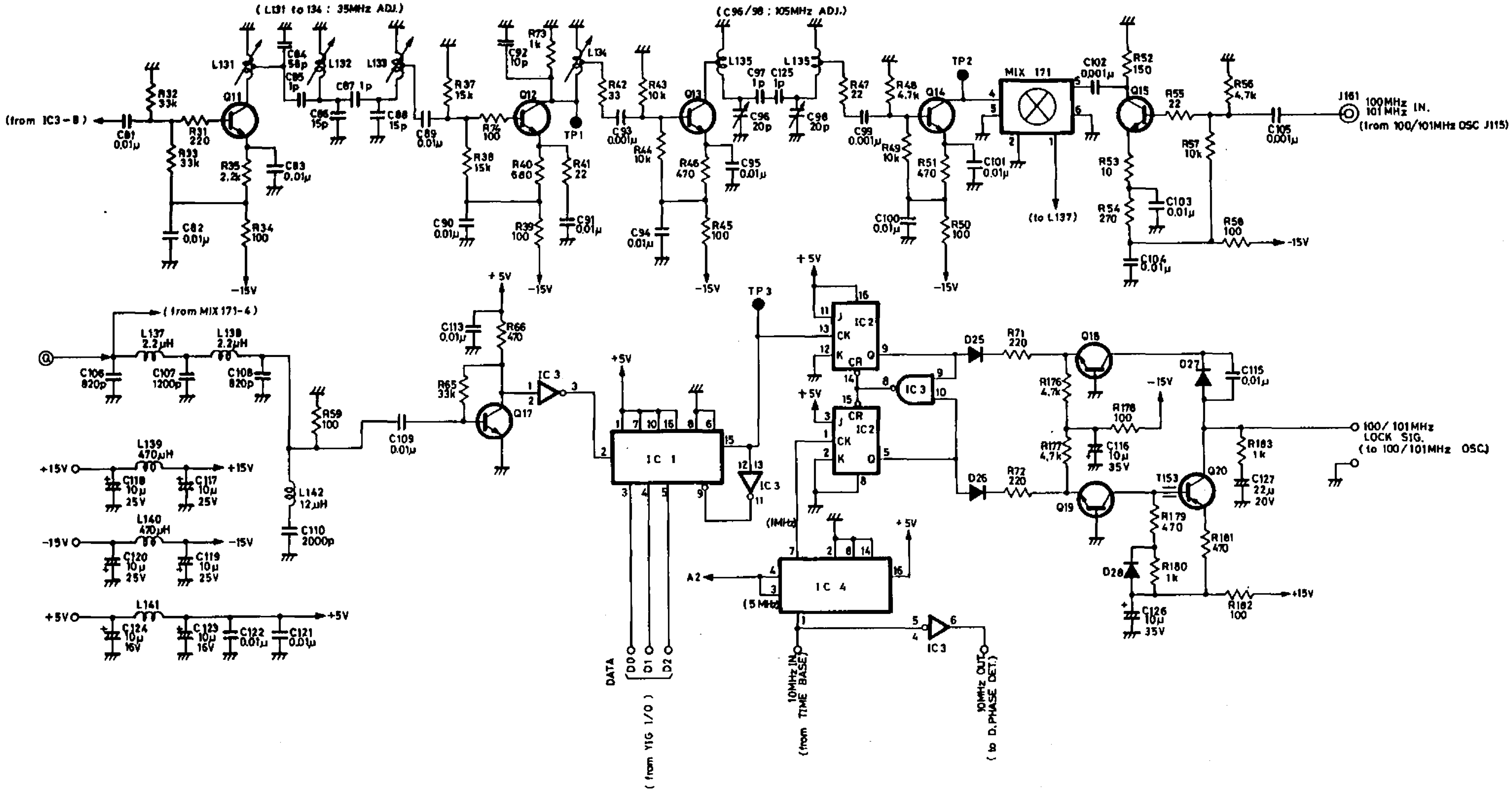


0069311-071-C



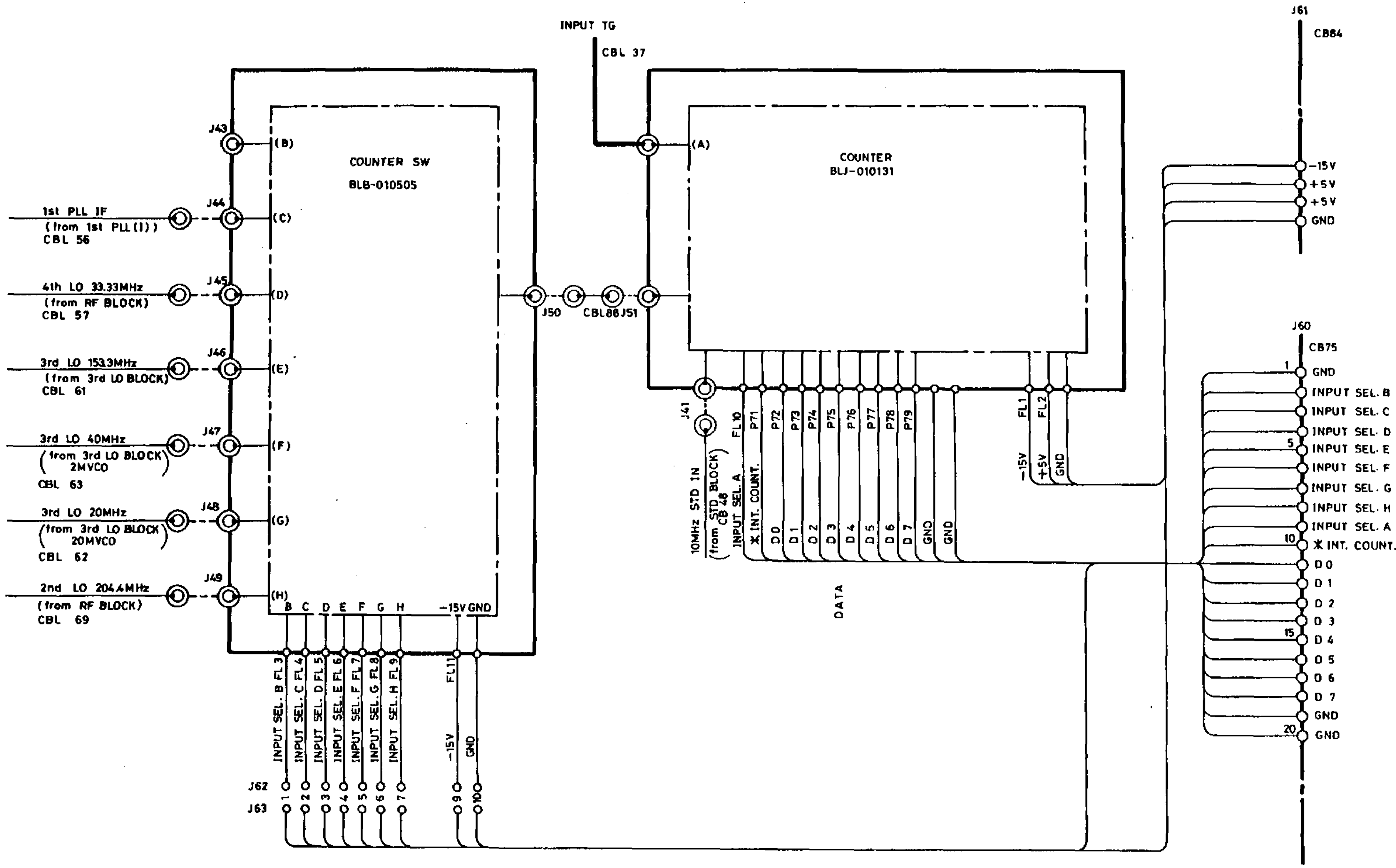
71

TR4172
PLL FILTER
BLB−010119



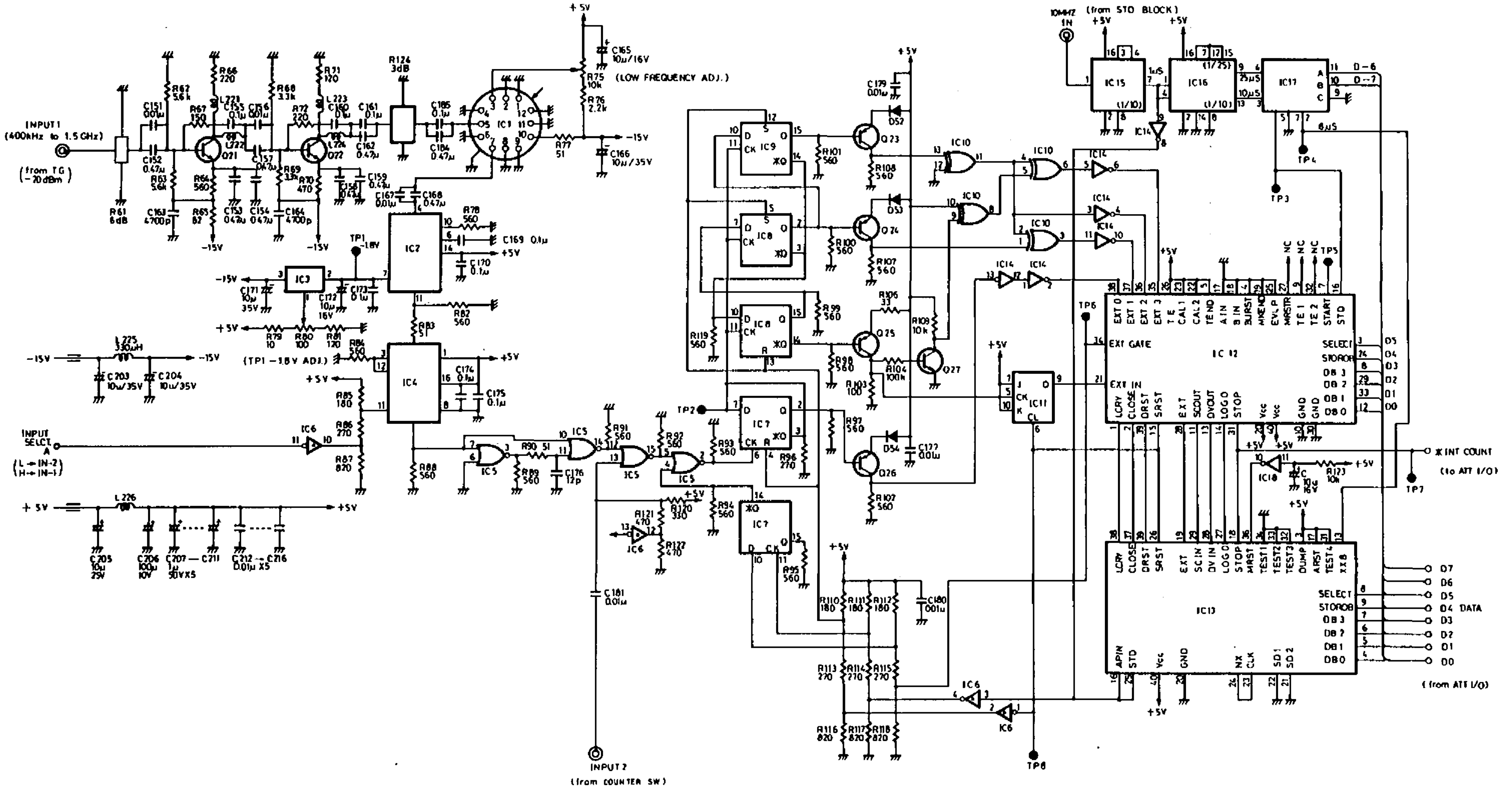
0069311 -072-E

TR4172
72
100/101MHz OSC. PLL
BLB-010120



0069209-073-B

TR4172
73 COUNTER BLOCK
MEP-349

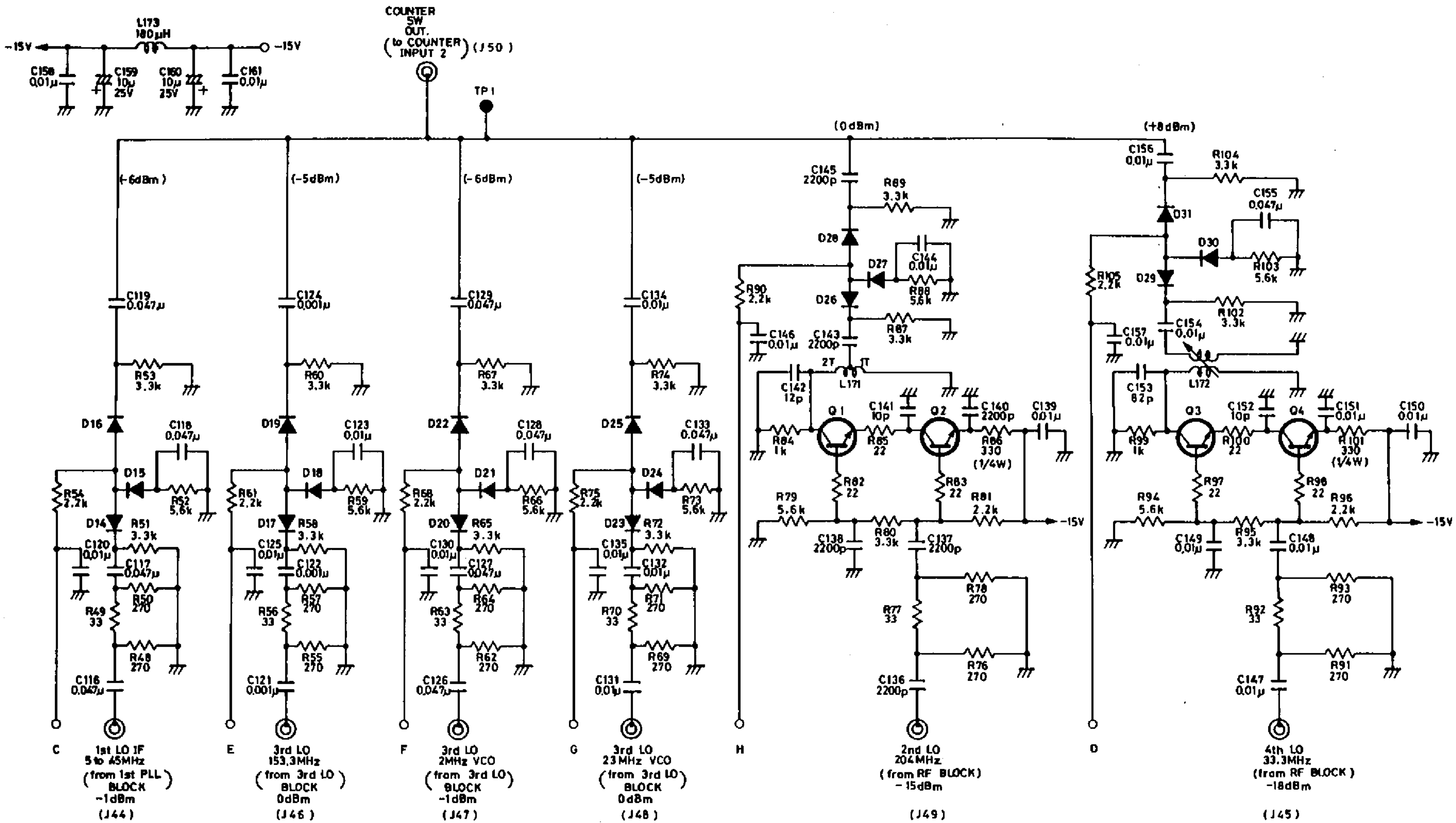


0069305-074-D

TR4172

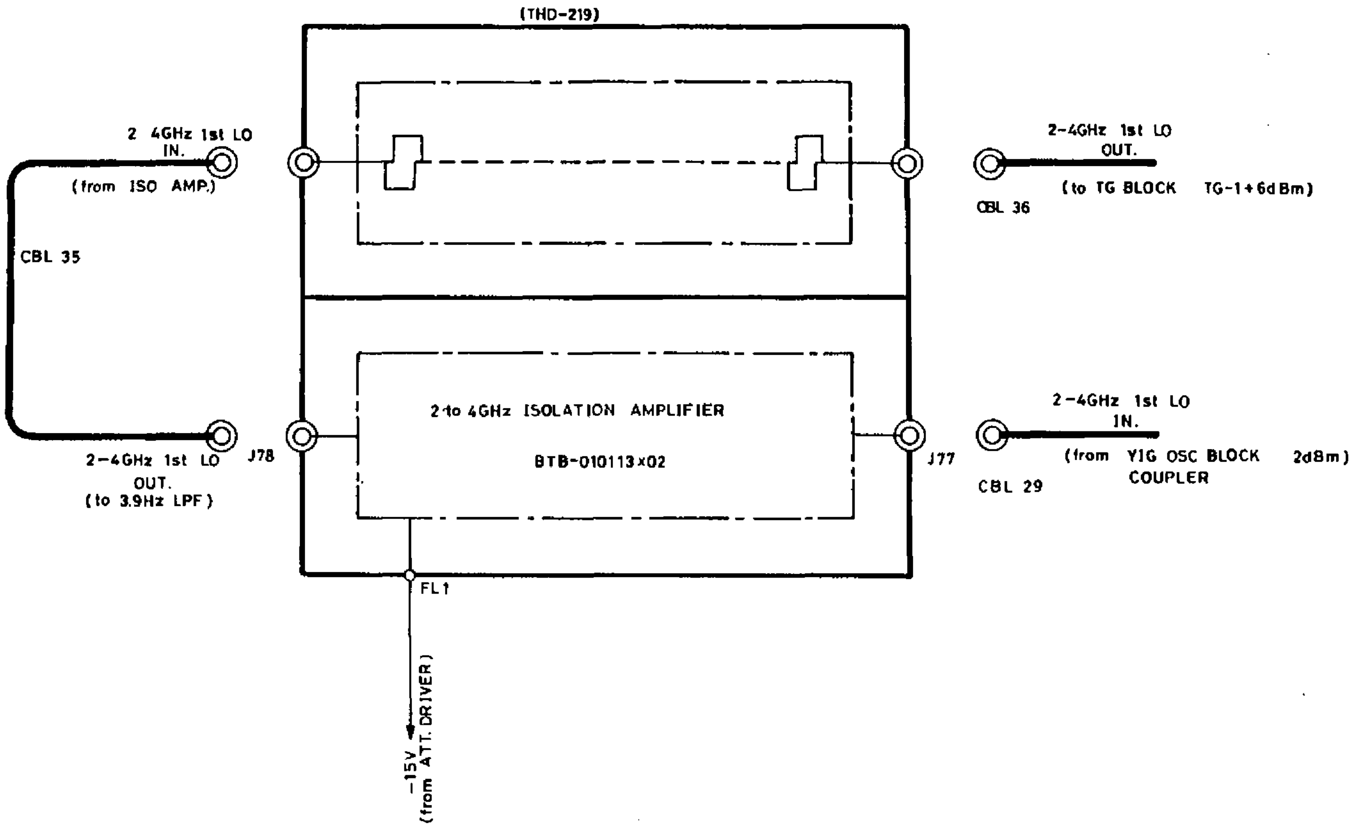
74 COUNTER

BLJ-010131



0069209 - 075 - A

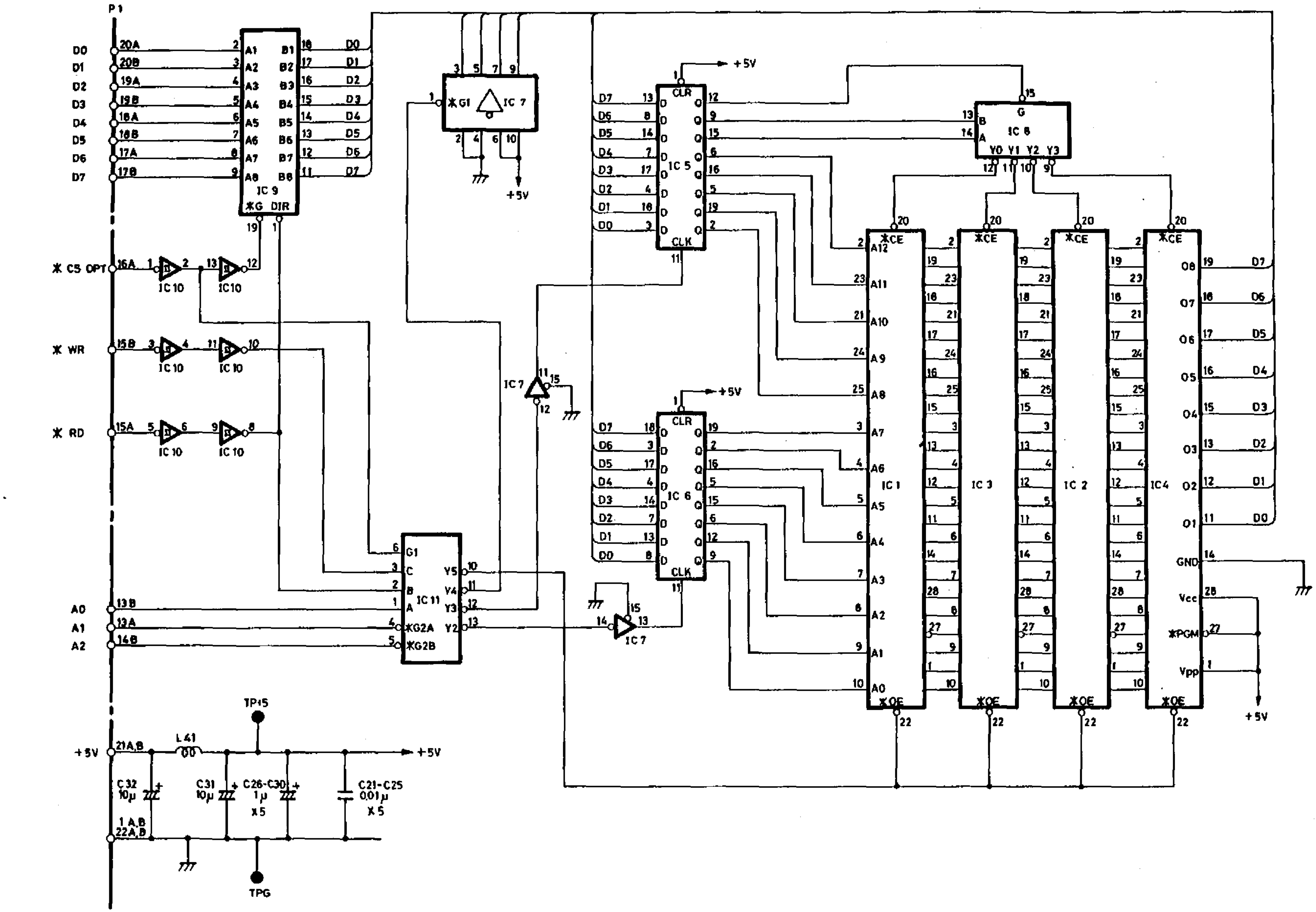
75 TR4172
COUNTER SWITCH
BLB-010505



0069209-076-B

76

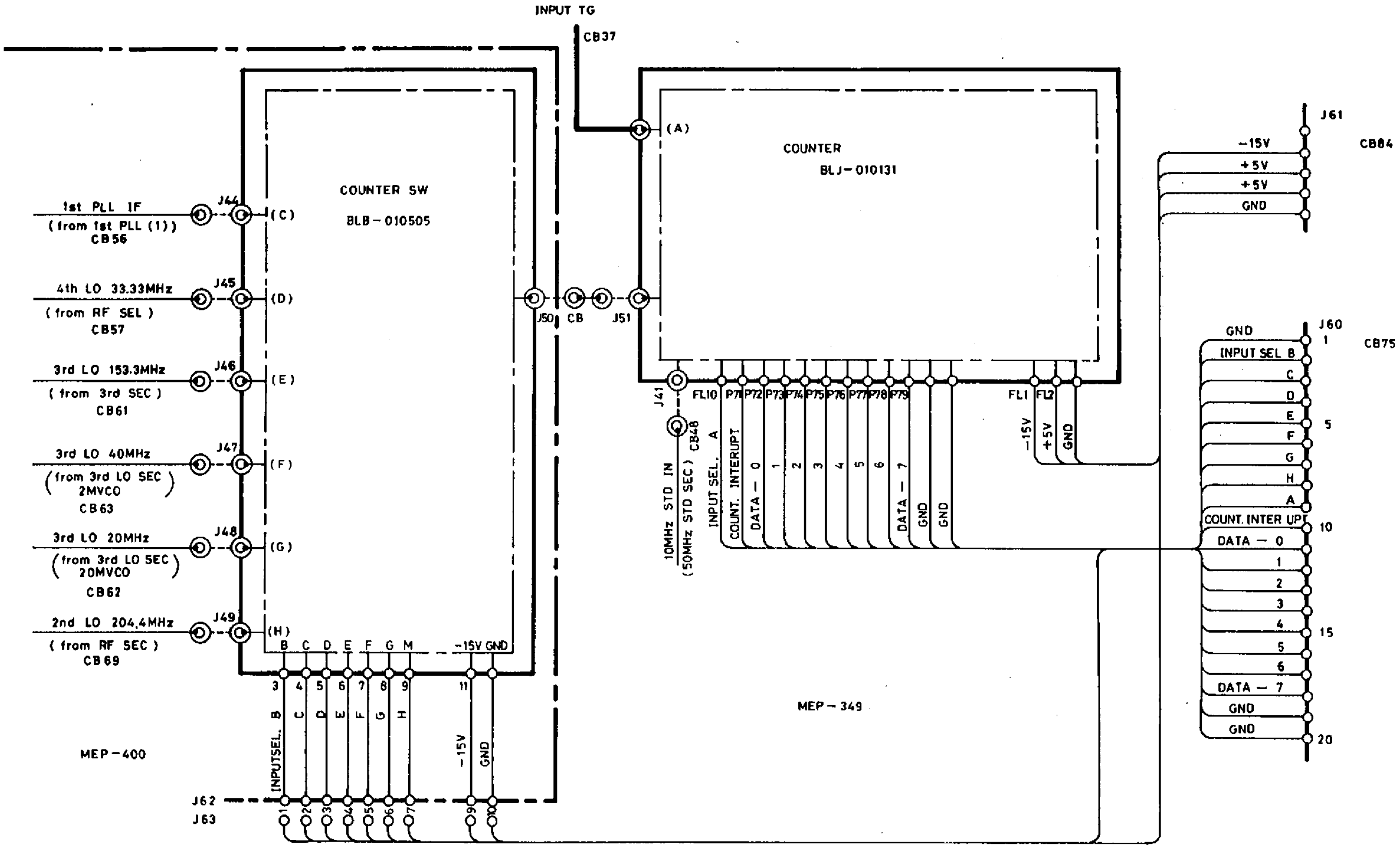
TR4172
3.9GHz L.P.F. BLOCK
MEP-351



0069302-077-A

77

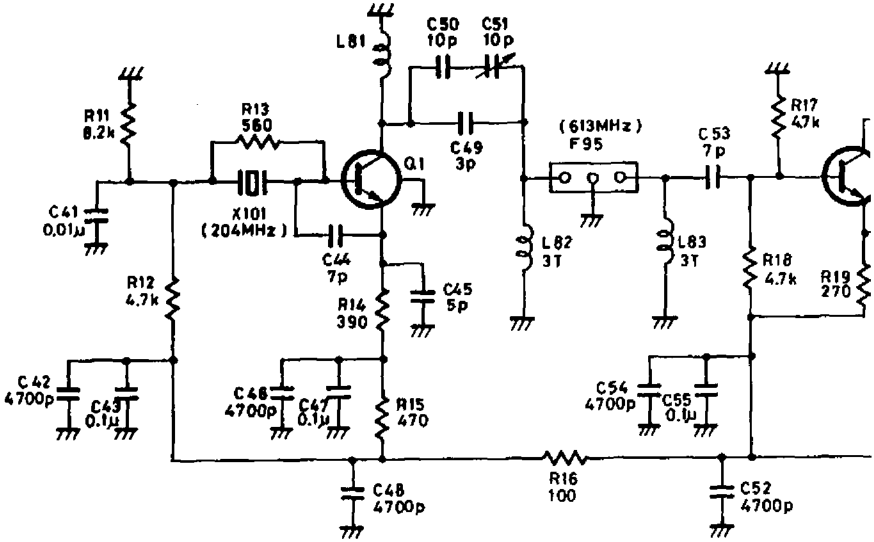
TR4172
OPTION MEMORY
BGC-010481

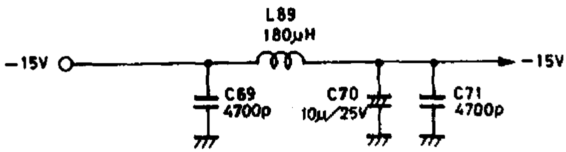


0089502-078 - A

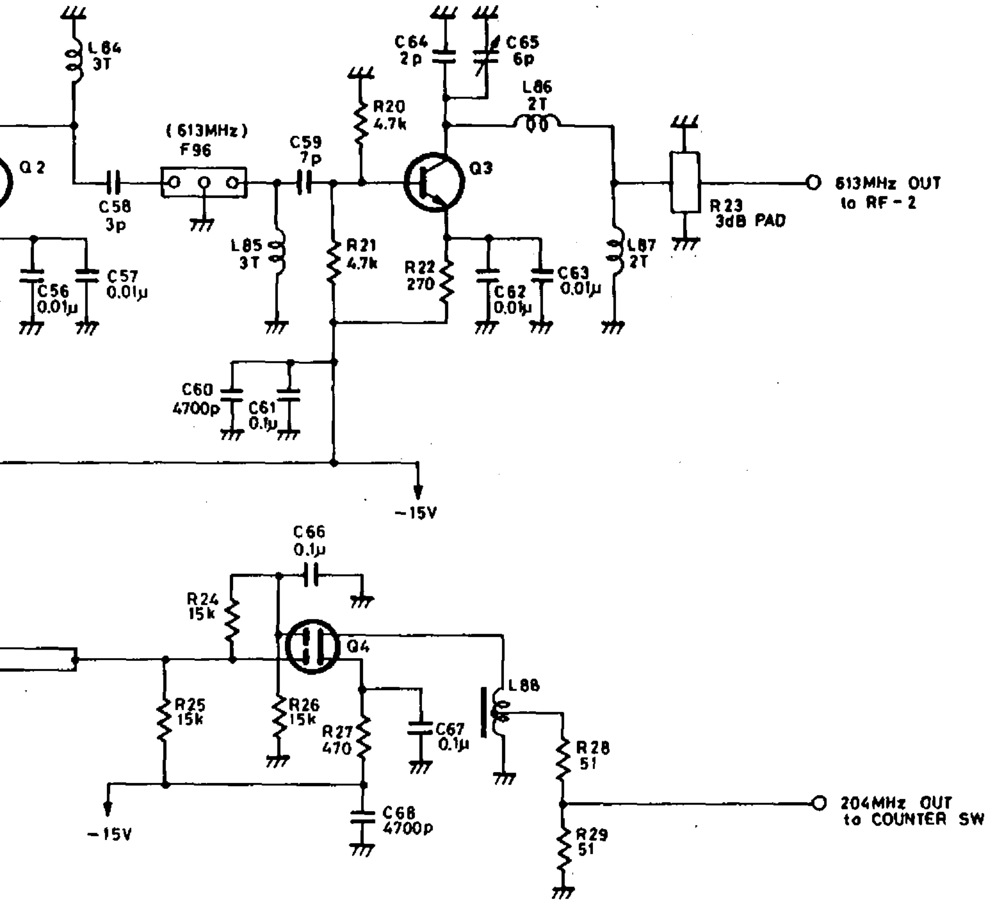
78

TR4172
COUNTER SW BLOCK
MEP-349/400

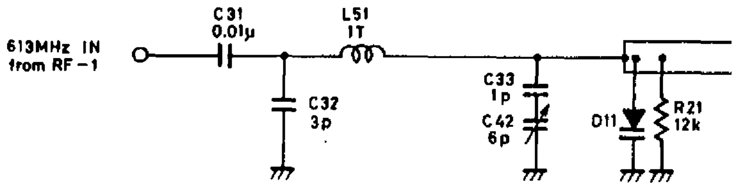




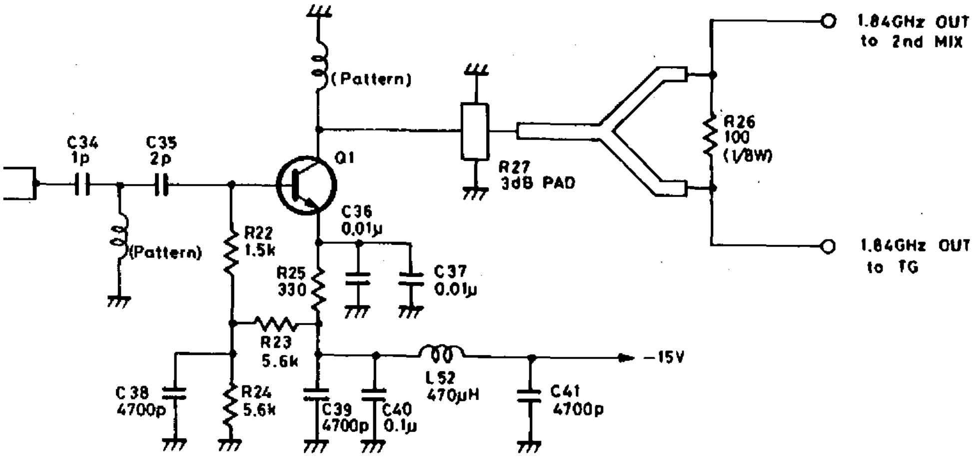
0069502—079—A



TR4172
RF-1
BLB-011297

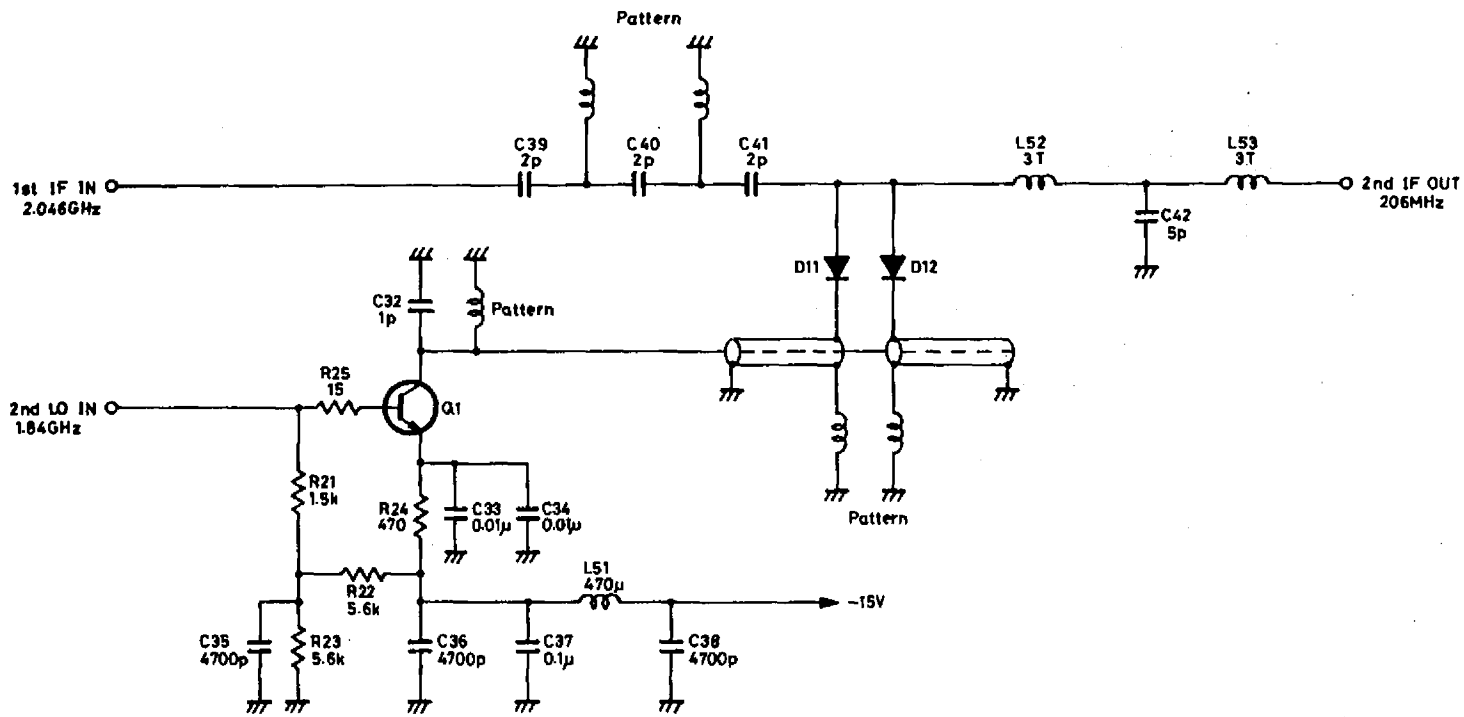


0069502-080-A



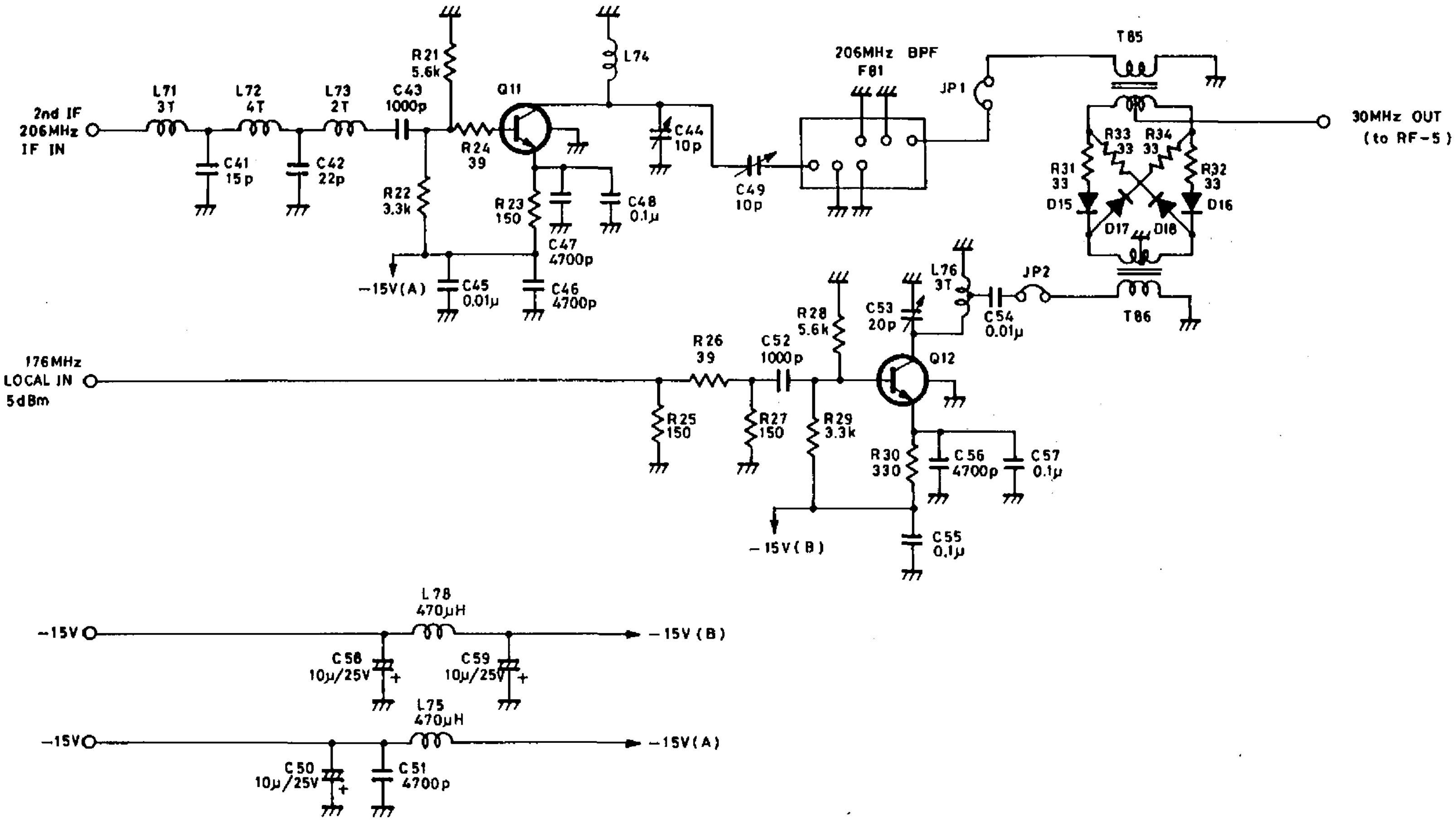
80

TR4172
RF-2
BLB-011298



006?502-081-A

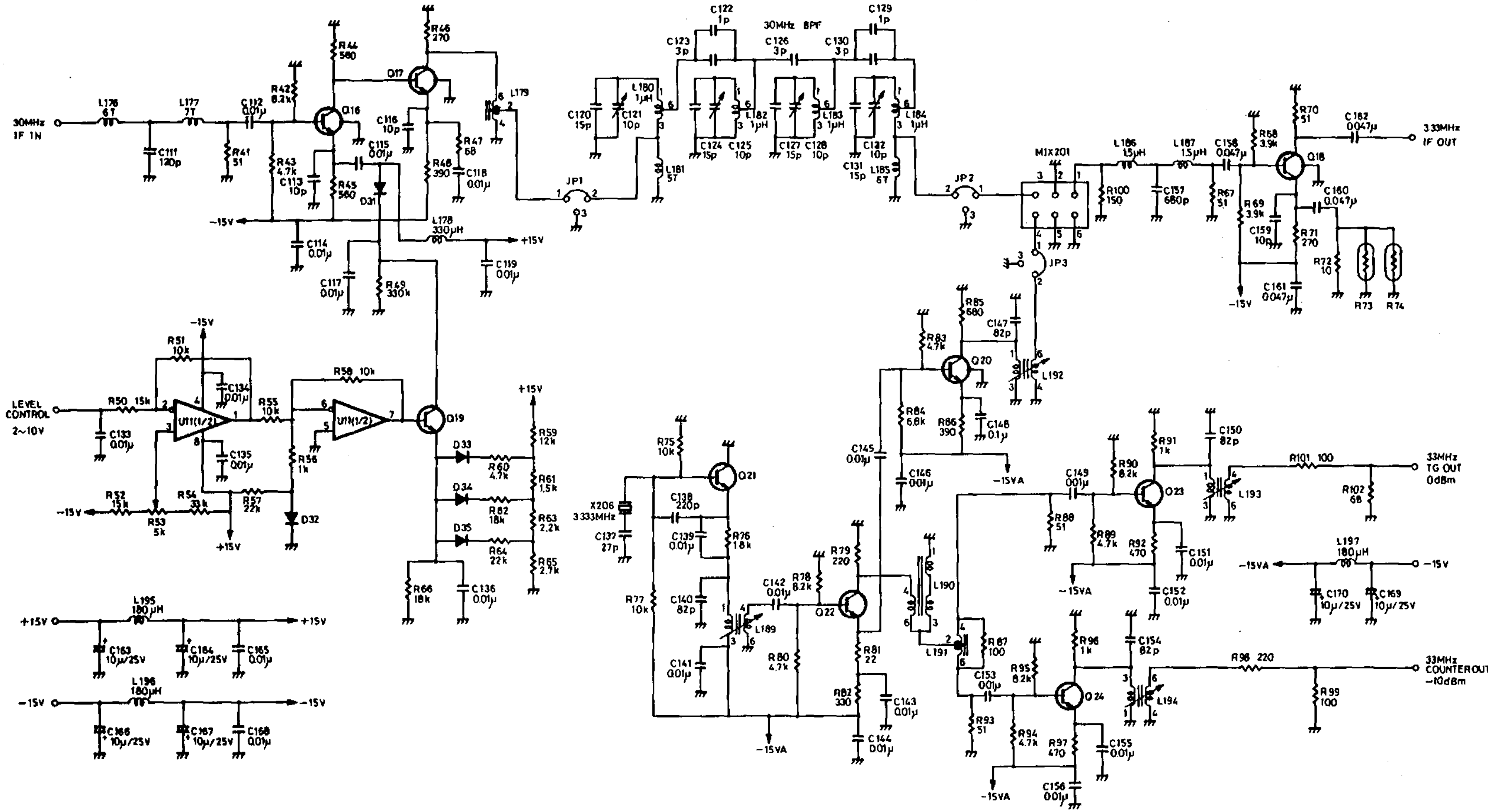
81 TR4172
RF-3
BLB-011299



0089502−082−A

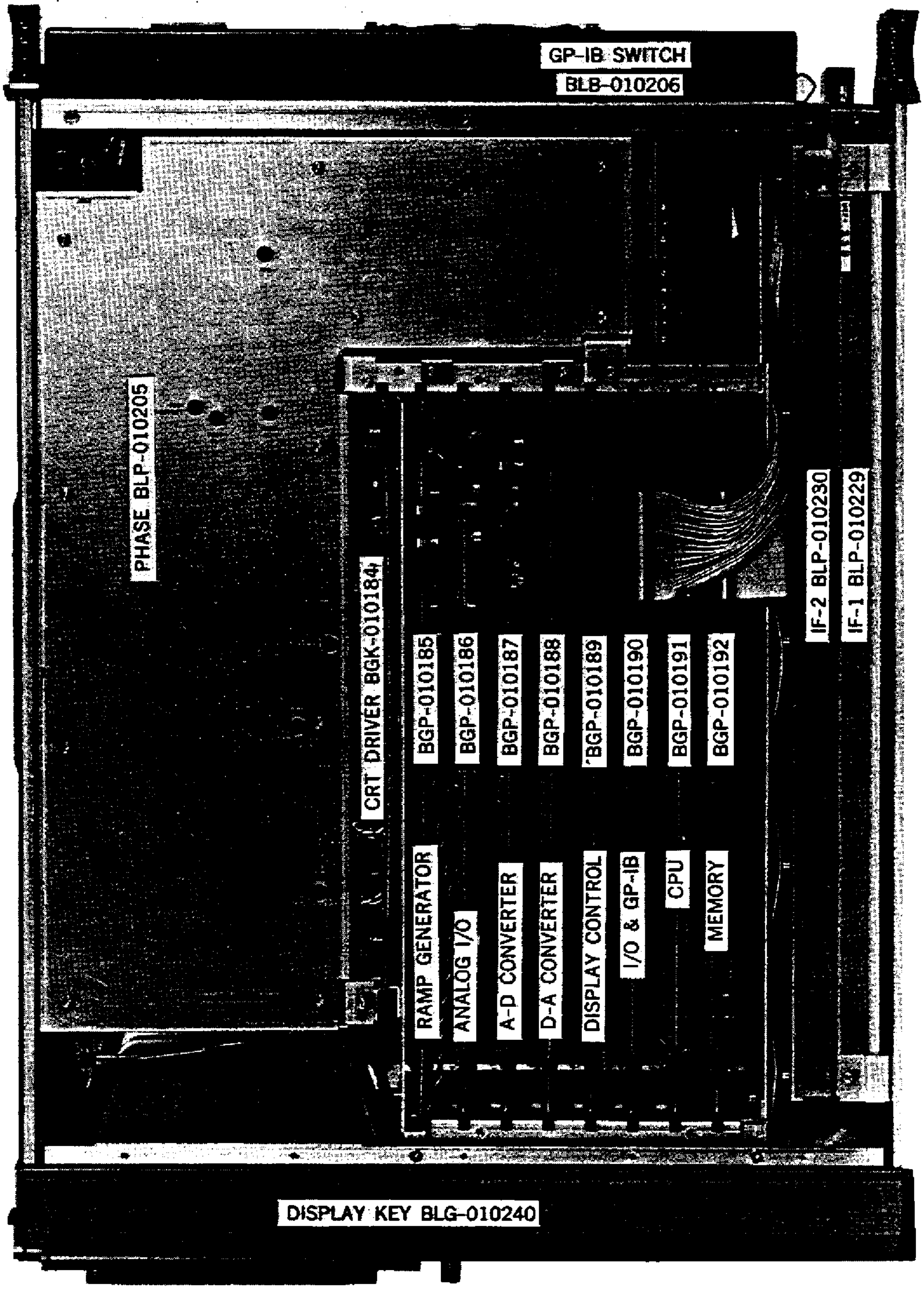
82

TR4172
RF−4
BLC−011300

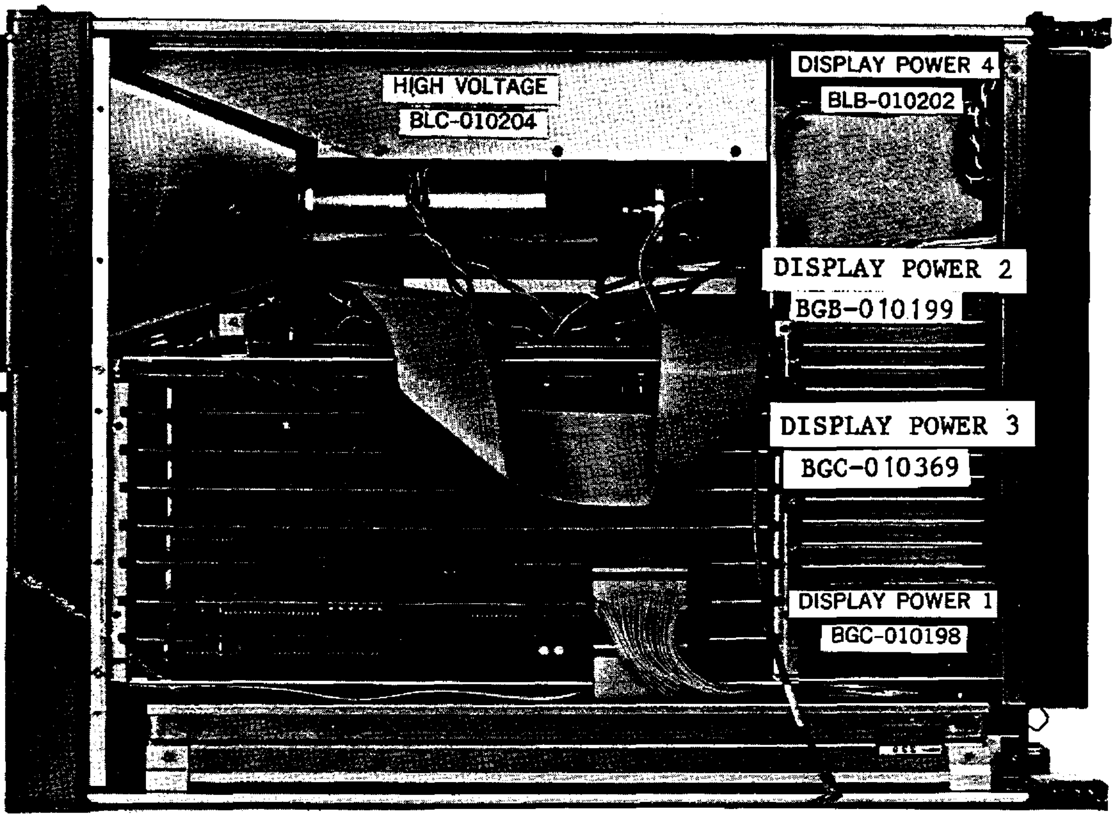


TR4172
RF-5
BLF-011301

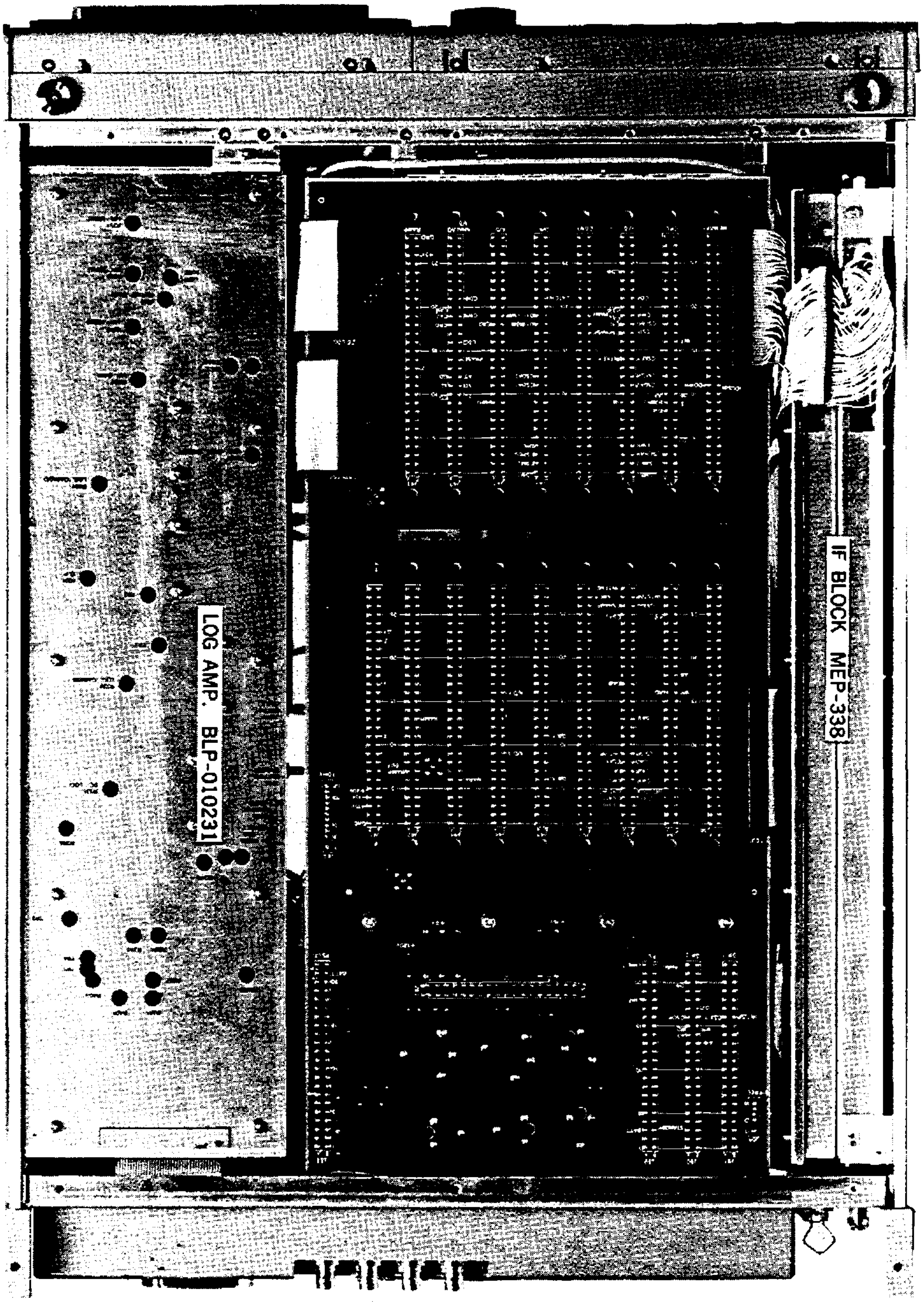
0069502-083-A



TR4172 Parts Allocations - 1

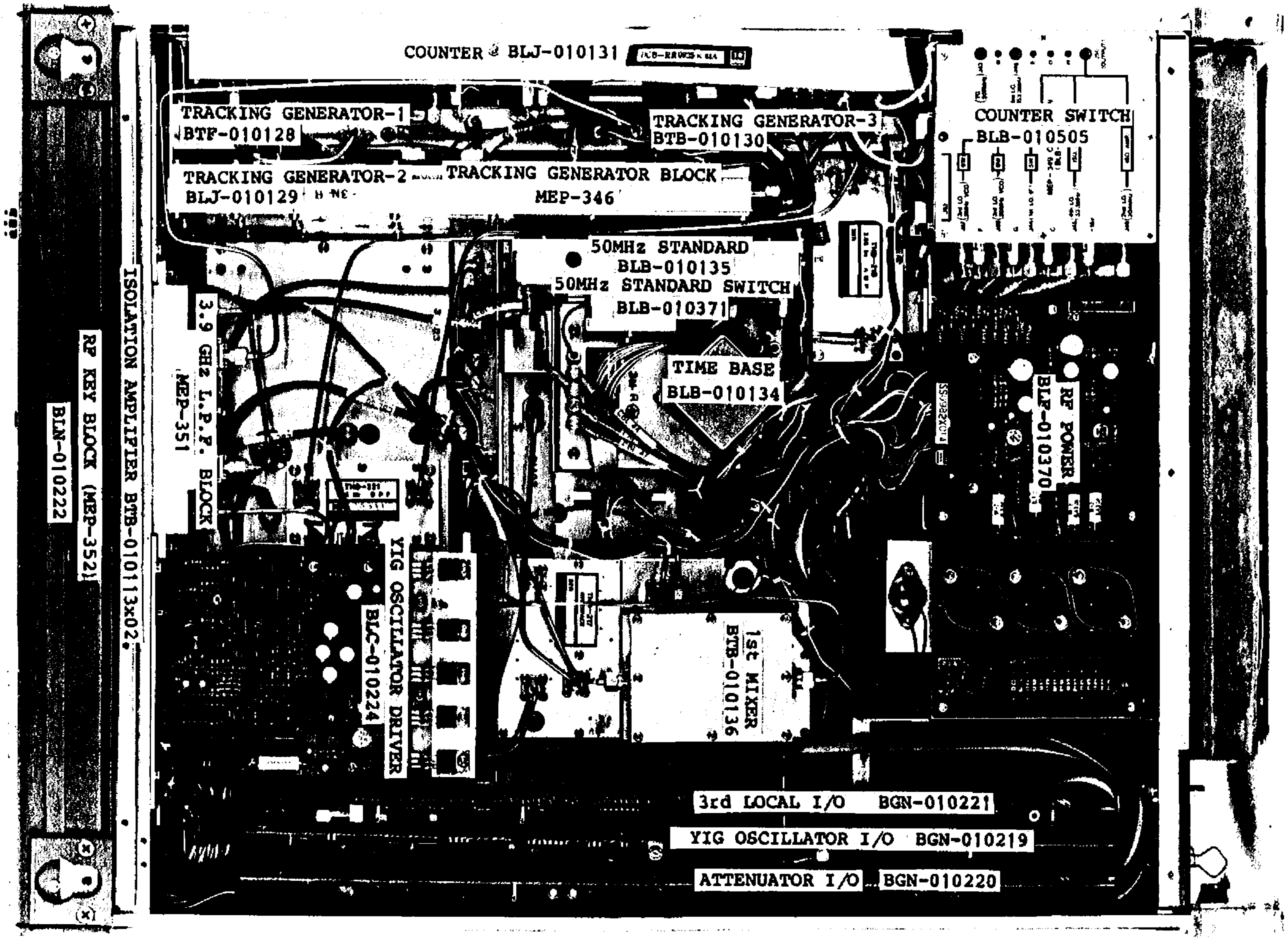


TR4172 Parts Allocations - 2



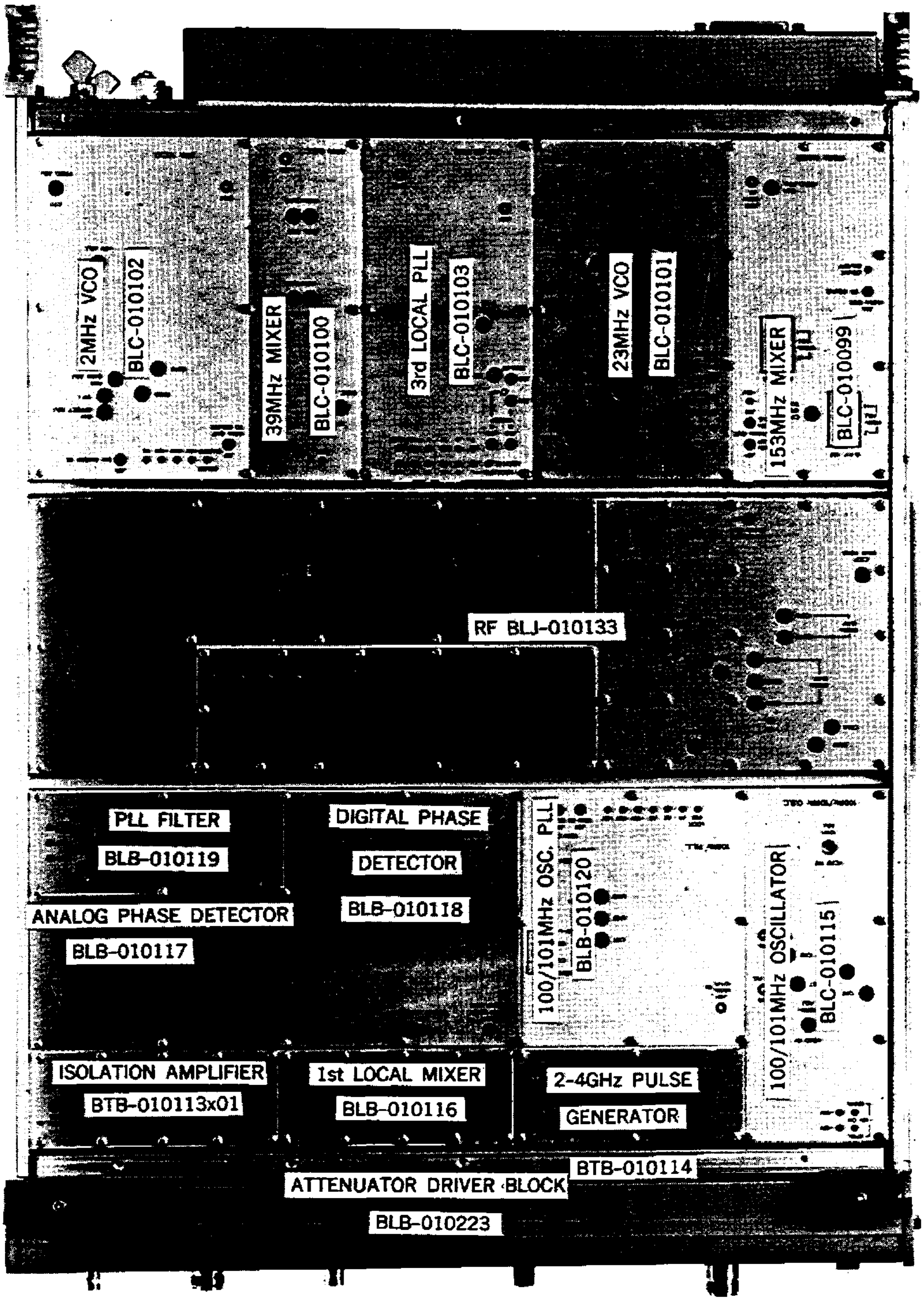
TR4172 Parts Allocations - 3

DISPLAY Section Bottom View



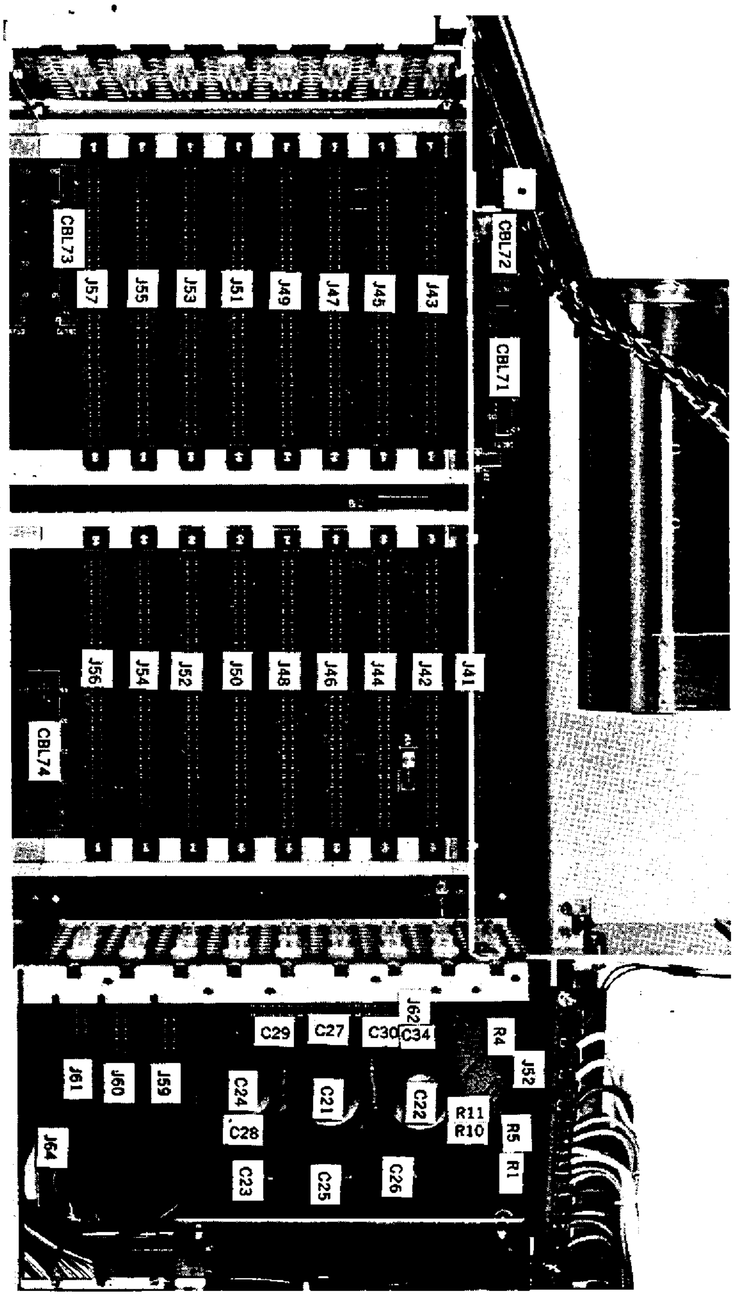
TR4172 Parts Allocations - 4

RF Section Top View

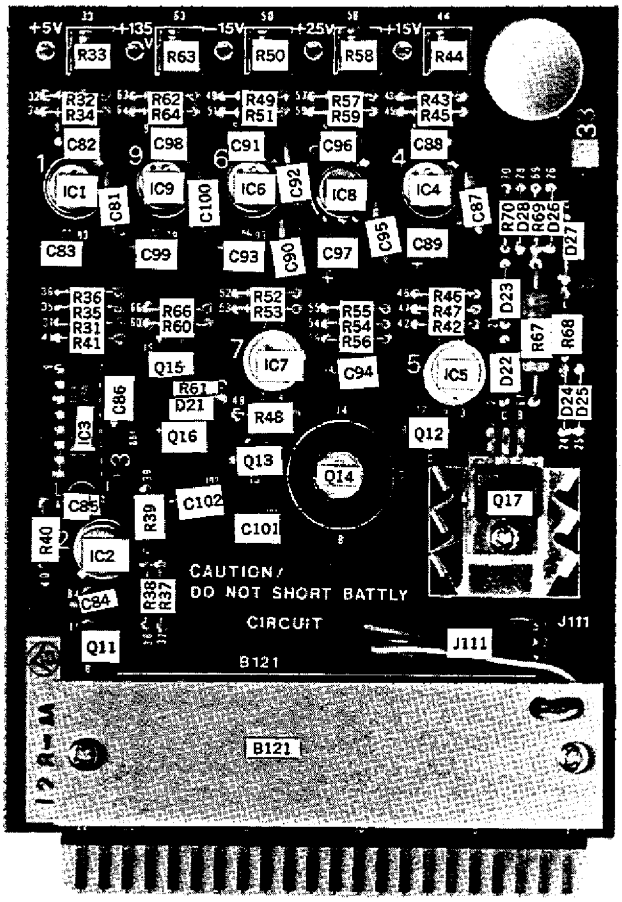


TR4172 Parts Allocations - 5

RF Section Bottom View

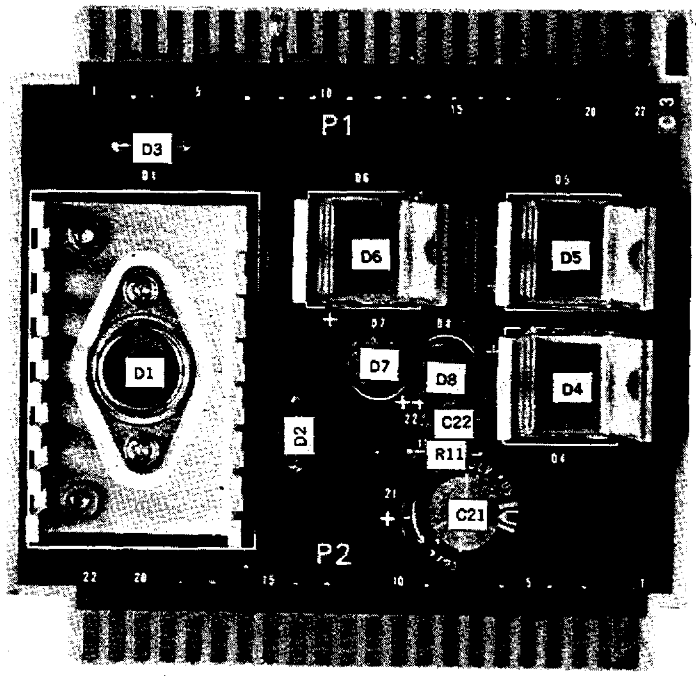


TR4172 Parts Allocations - 6

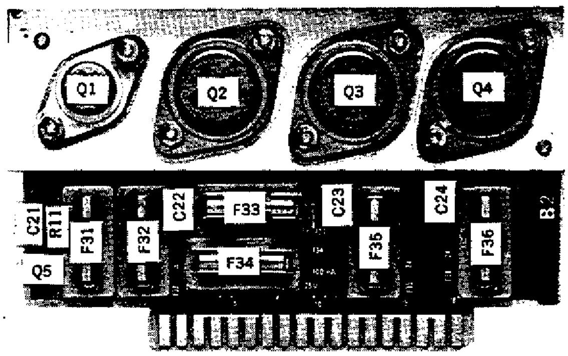


TR4172 Parts Allocations - 7

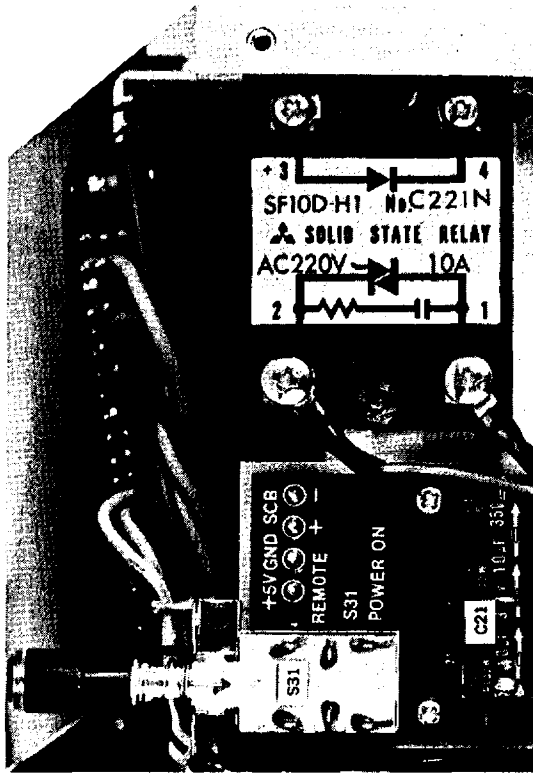
7

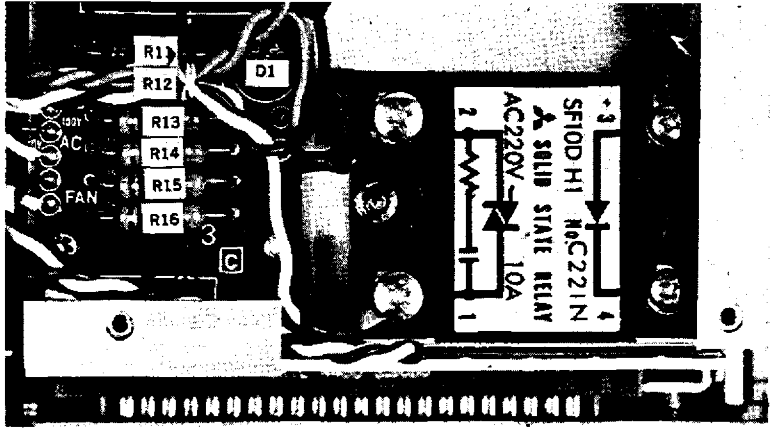


TR4172 Parts Allocations - 8

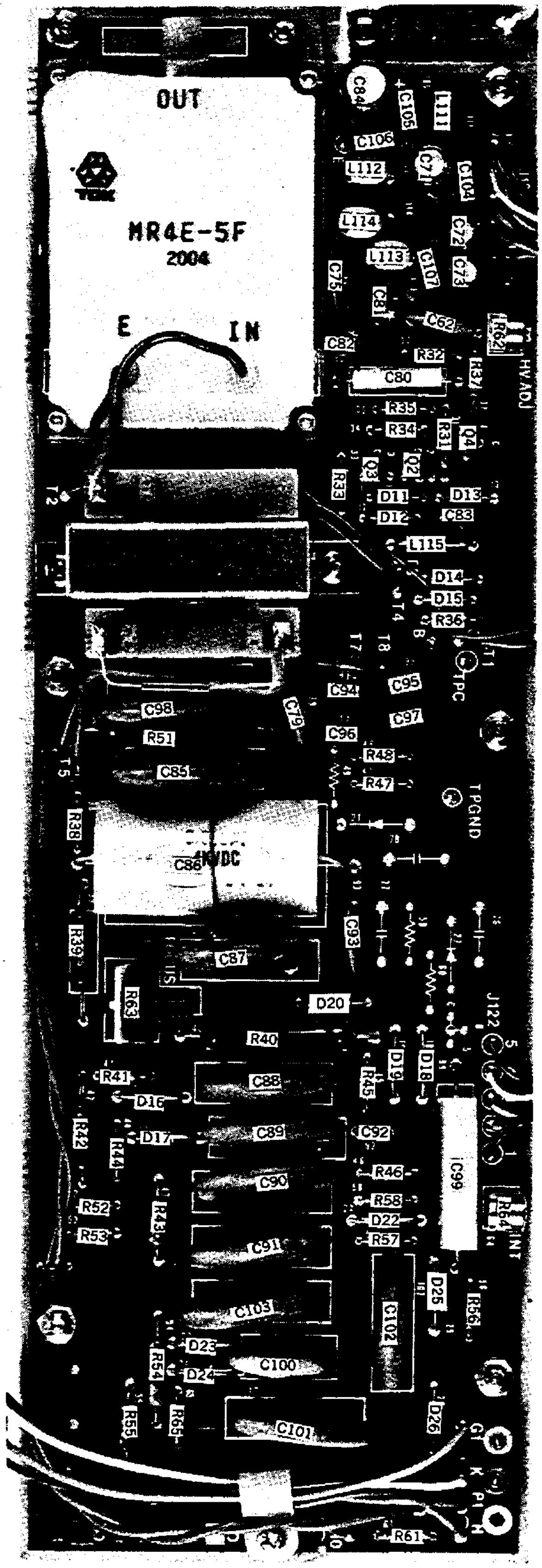


TR4172 Parts Allocations - 9


SF10D-H1 No.C221N
SOLID STATE RELAY
AC220V 10A
+5VGND SCB
REMOTE
S31
POWER ON
S31
C21

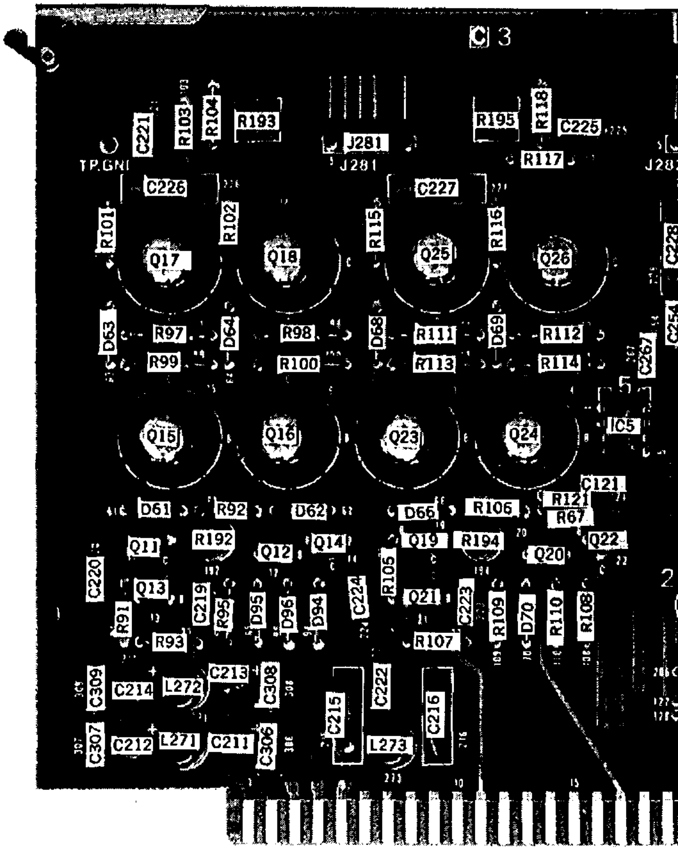


TR4172 Parts Allocations - 10



TR4172 Parts Allocations - 11

//


C 3
TP.GND
C221
R103
R104
R193
J281
J281
R195
R118
C225
R117
C226
C227
R101
R102
R115
R116
Q17
Q18
Q25
Q26
C228
D63
R97
D64
R98
D68
R111
D69
R112
C254
R99
R100
R113
R114
C267
5
IC5
Q15
Q16
Q23
Q24
C121
R121
D61
R92
D62
D66
R106
R67
Q11
R192
Q12
Q14
Q19
R194
Q22
Q20
2
C220
Q13
R105
Q21
C224
C223
R91
C219
R95
D95
D96
D94
R109
D70
R110
R108
R93
R107
C309
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C213
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C215
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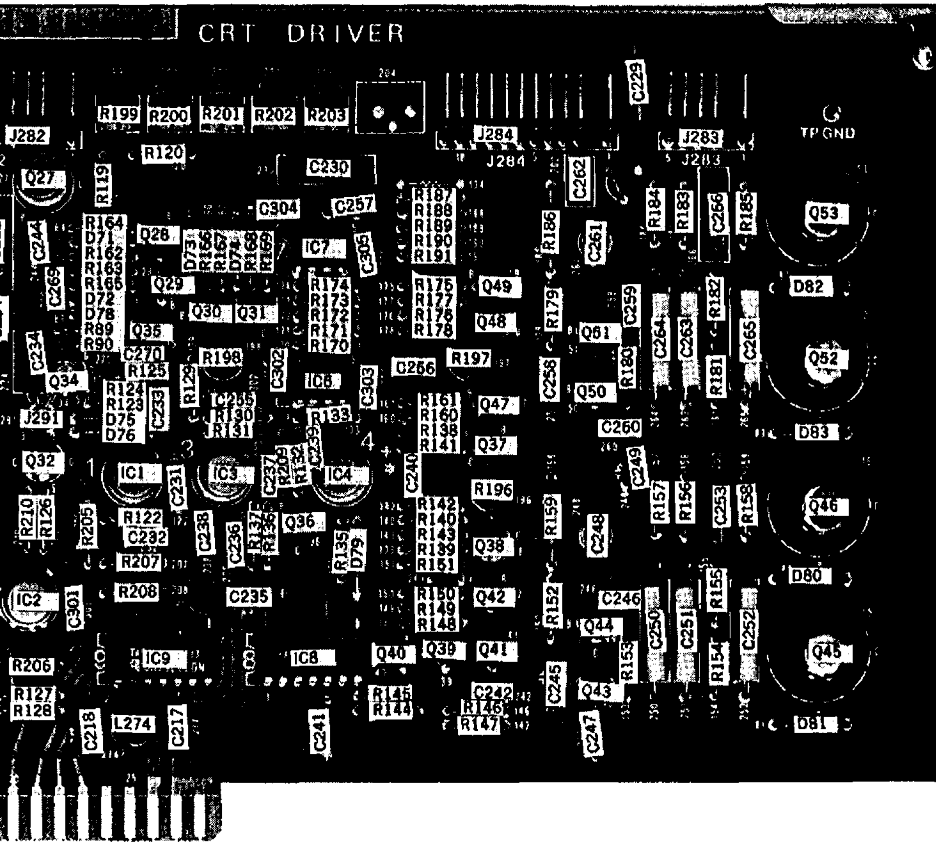
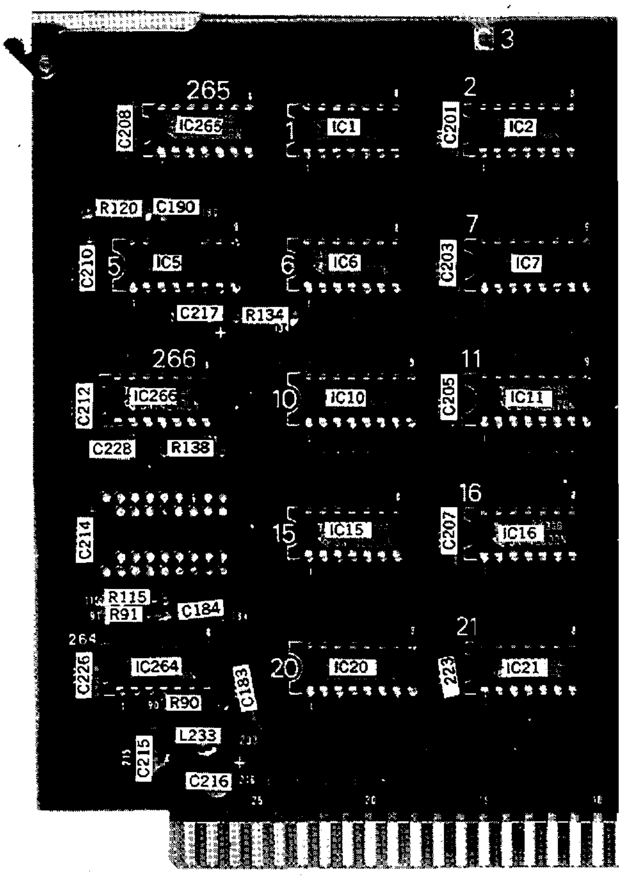
C212
L271
C211
C306
L273

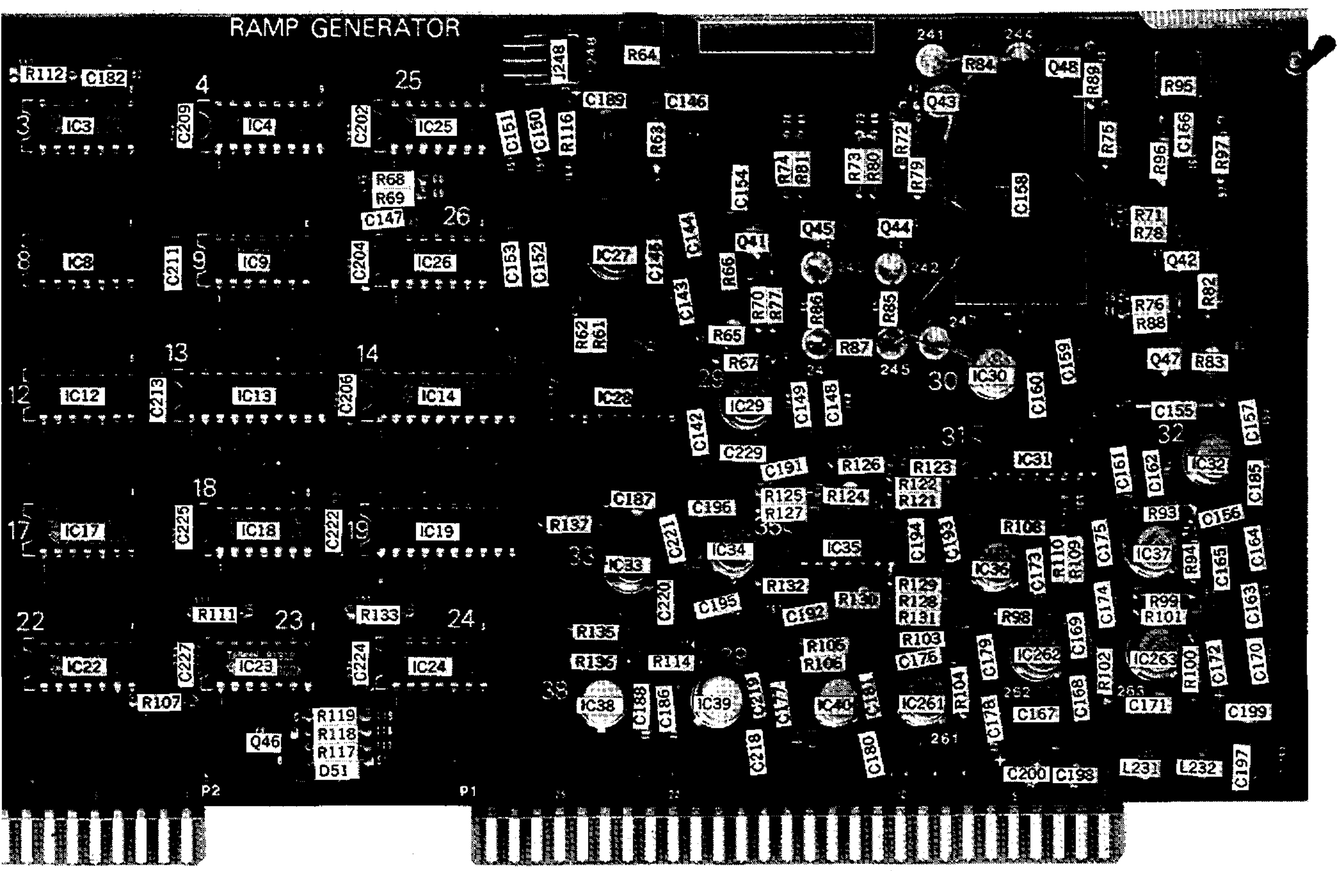


TR4172 Parts Allocations - 12

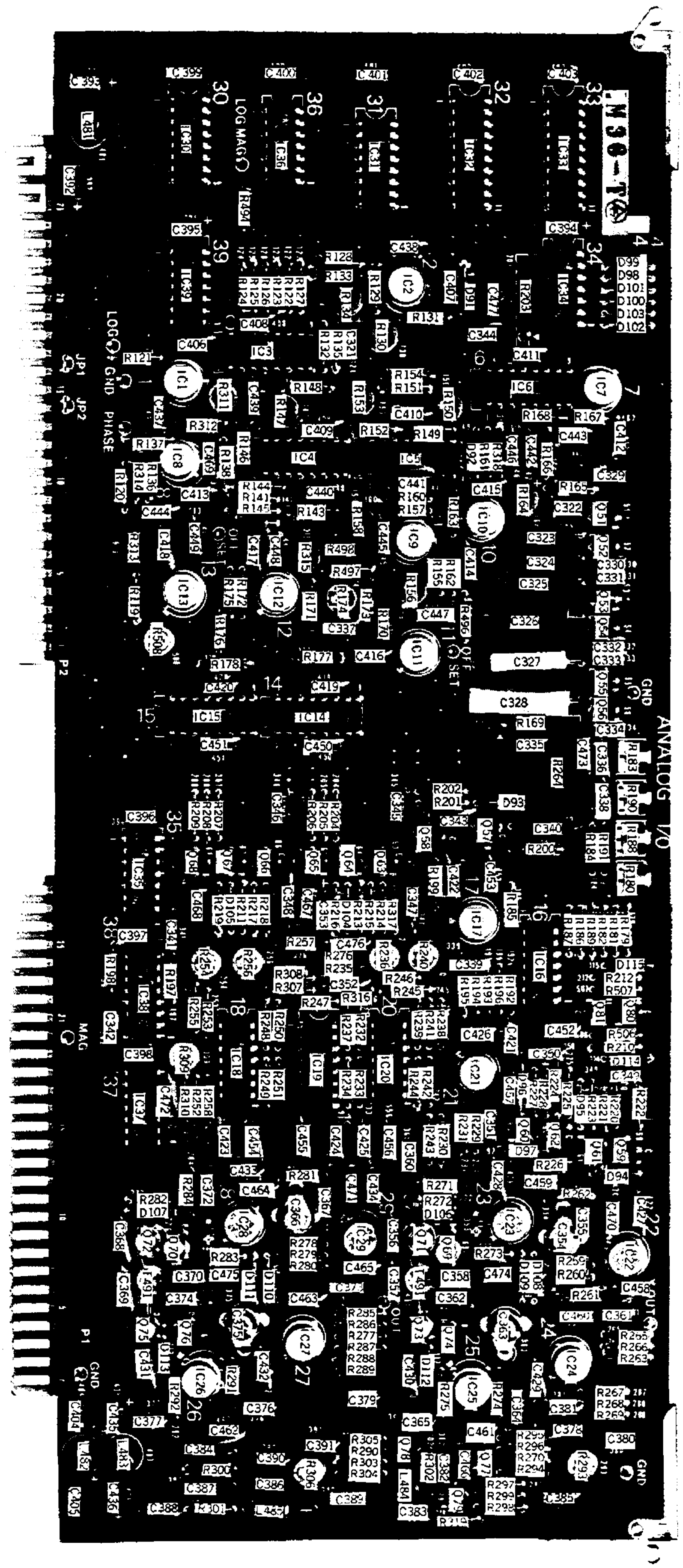
CRT DRIVER BGK-010184



RAMP GENERATOR BGP-010185

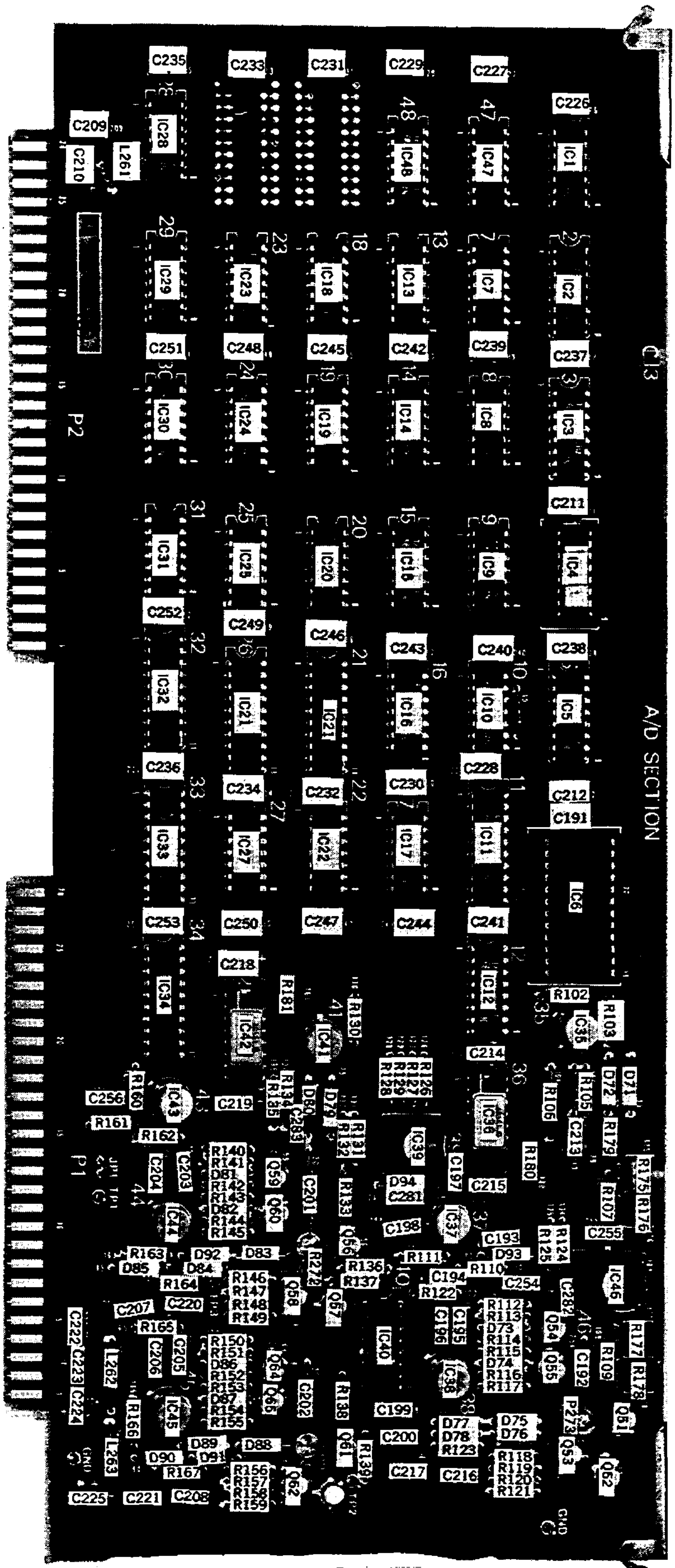


TR4172 Parts Allocations - 13



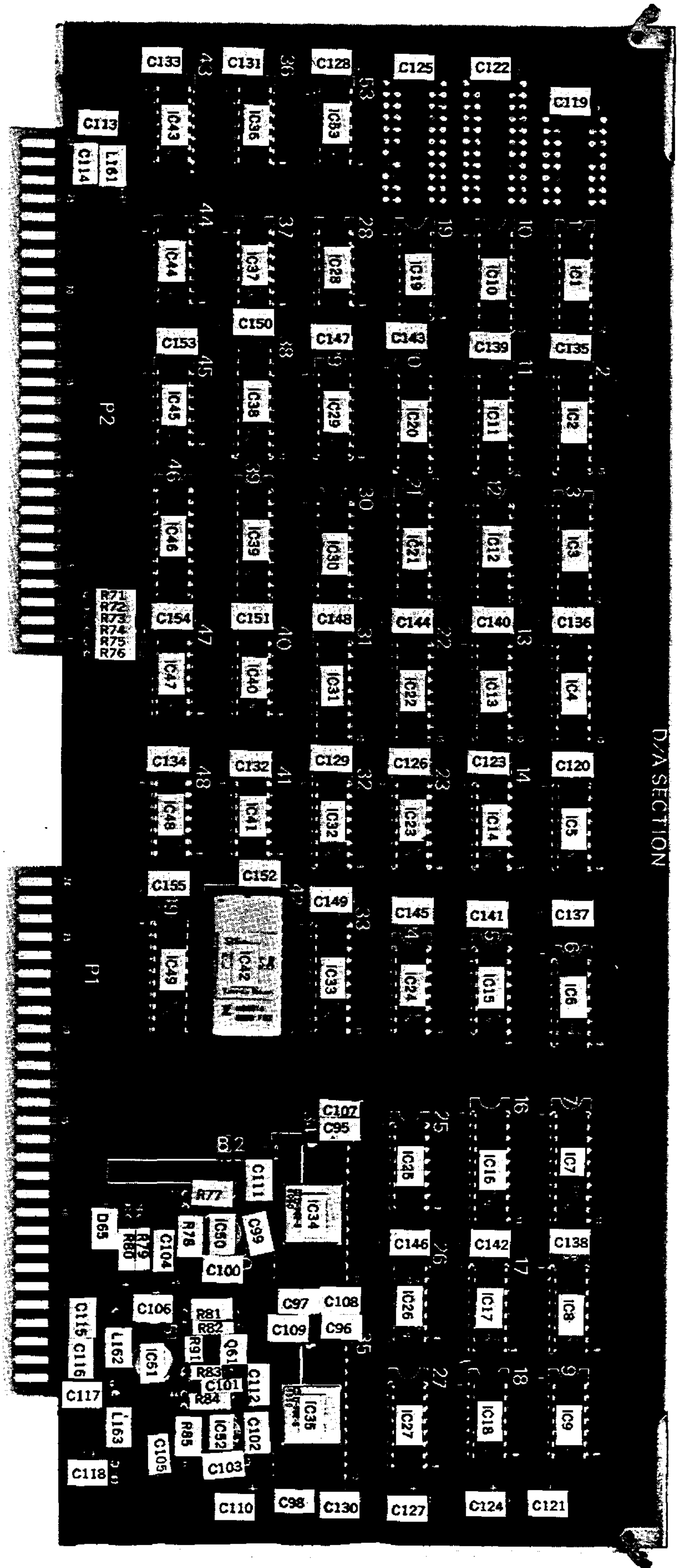
TR4172 Parts Allocations - 14

~~ANALOG I/O BGP-010186~~



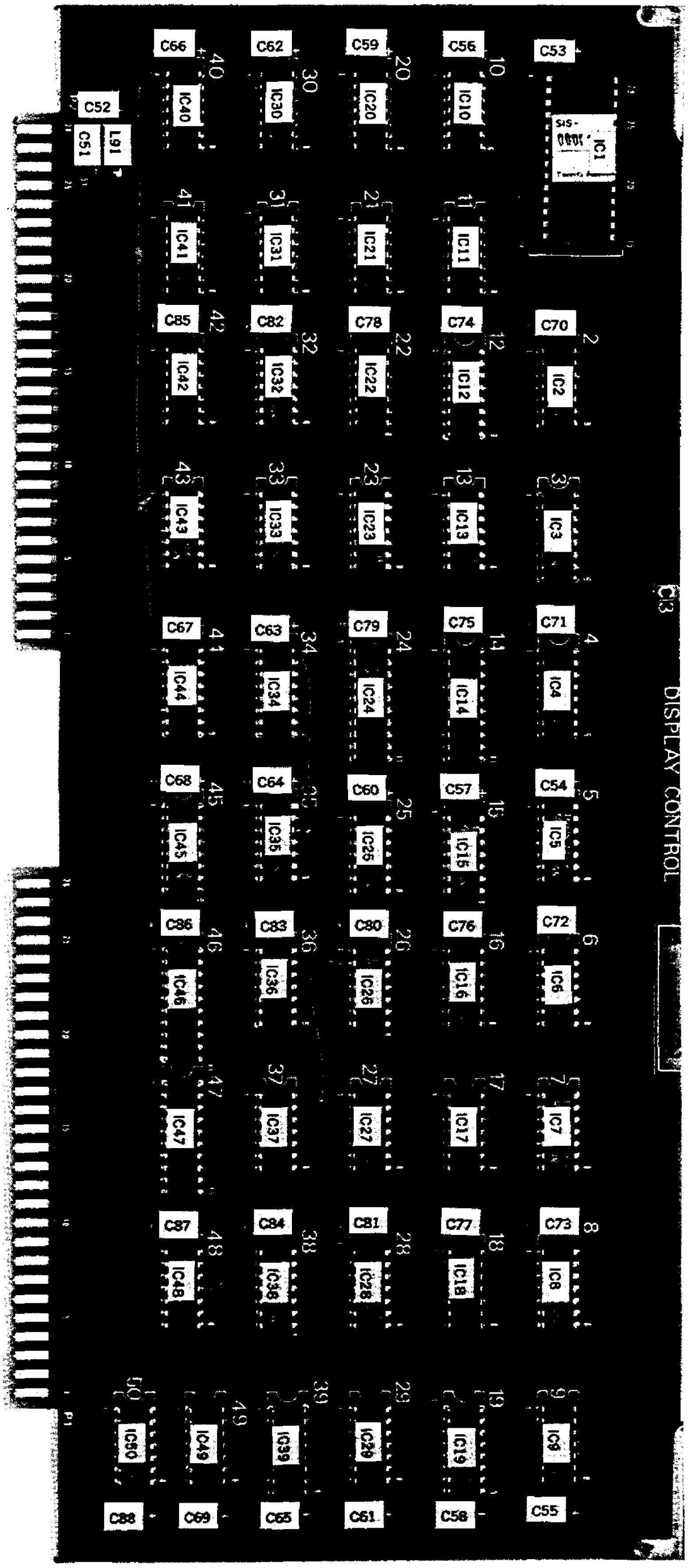
TR4172 Parts Allocations - 15

~~A-D CONVERTER BGP-010187~~



TR4172 Parts Allocations - 16

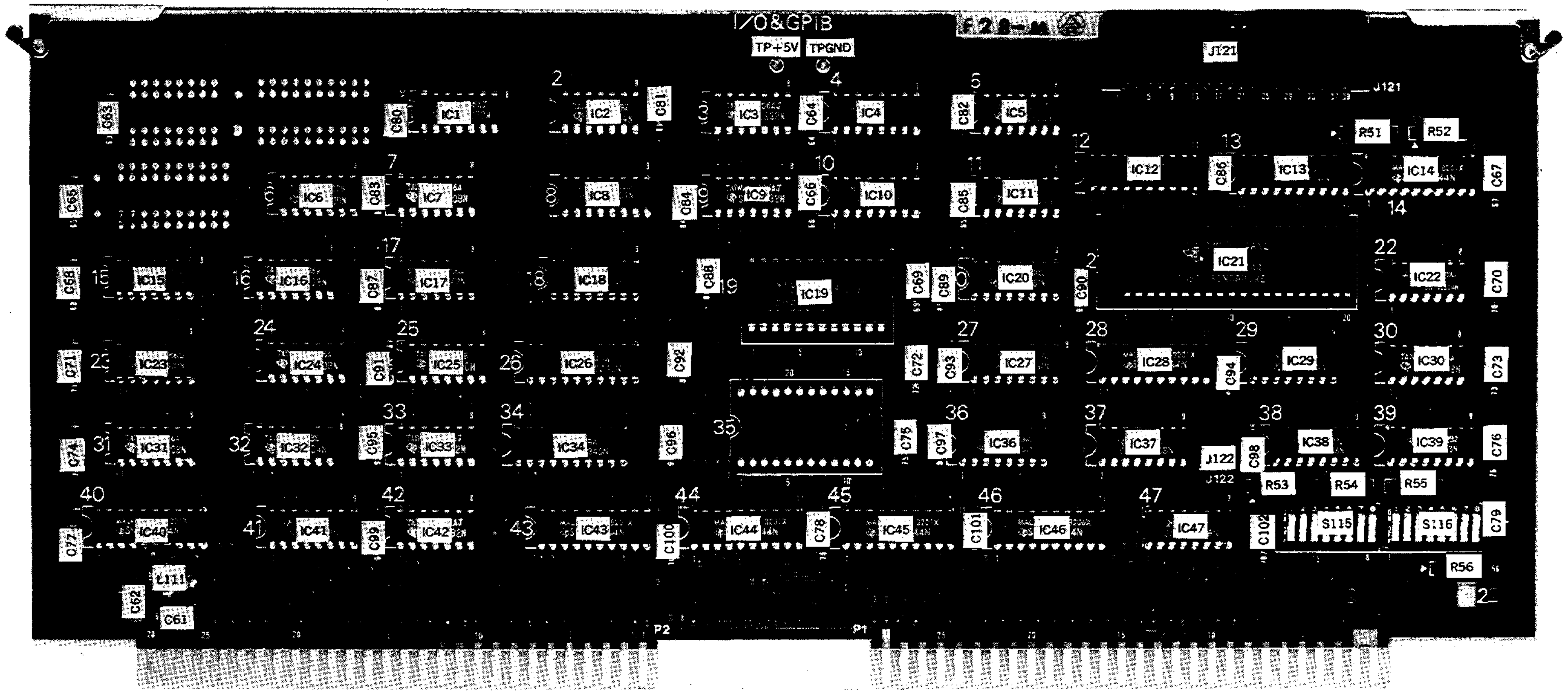
~~D-A CONVERTER BGP-010180~~



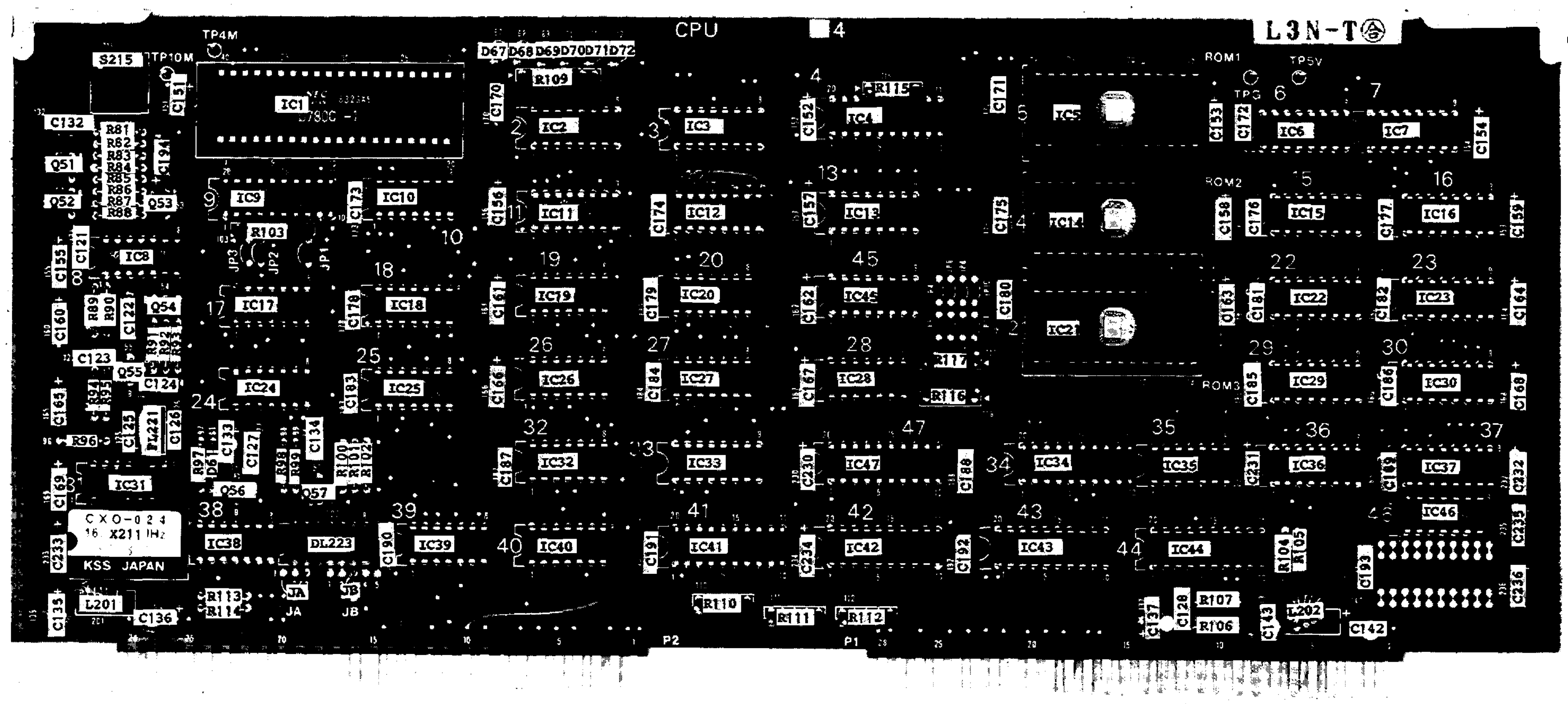
TR4172 Parts Allocations - 17

~~DISPLAY CONTROL BGP-010~~189

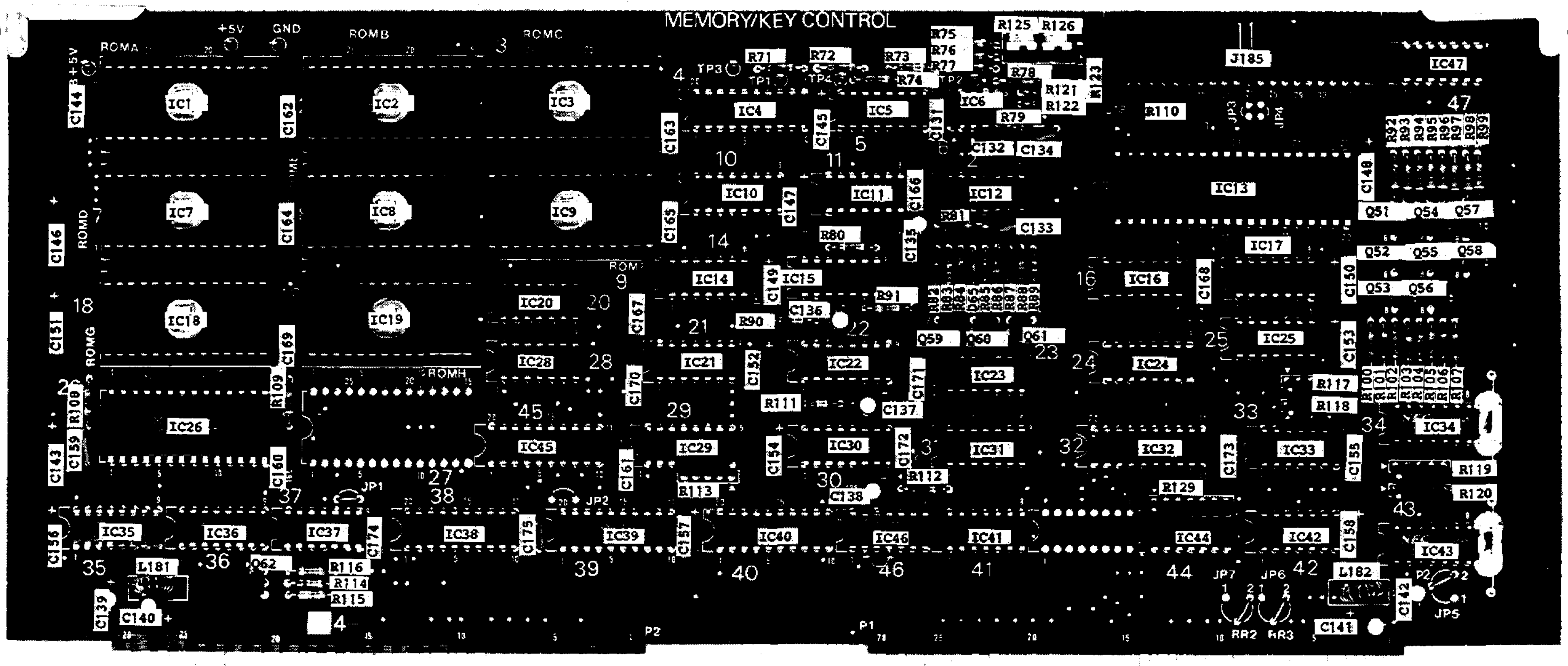
17



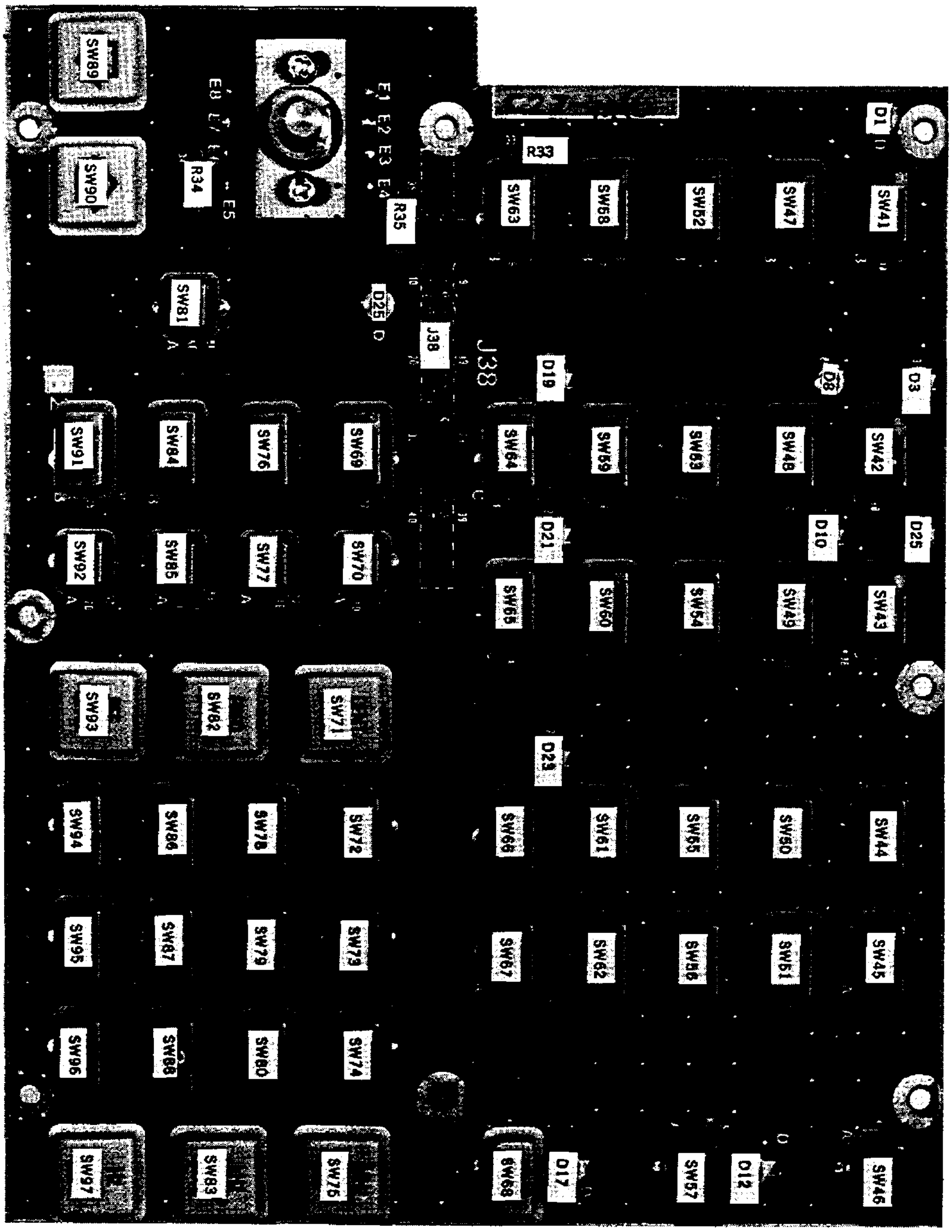
TR4172 Parts Allocations - 18



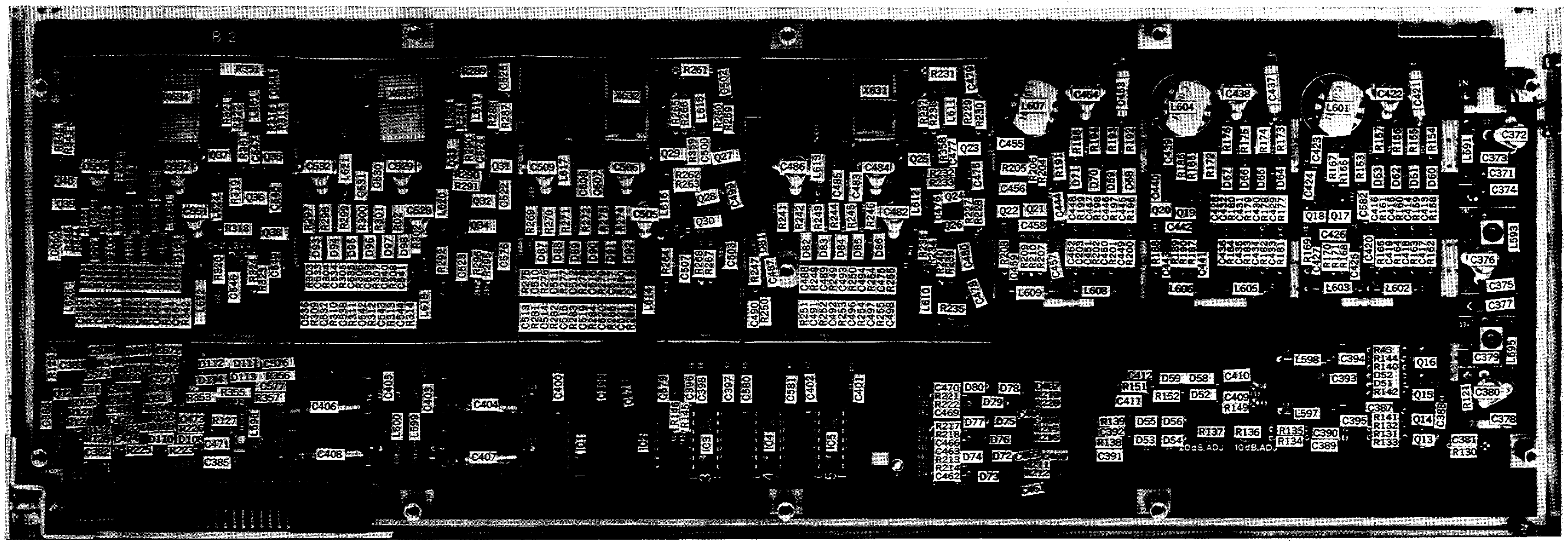
TR4172 Parts Allocations - 19



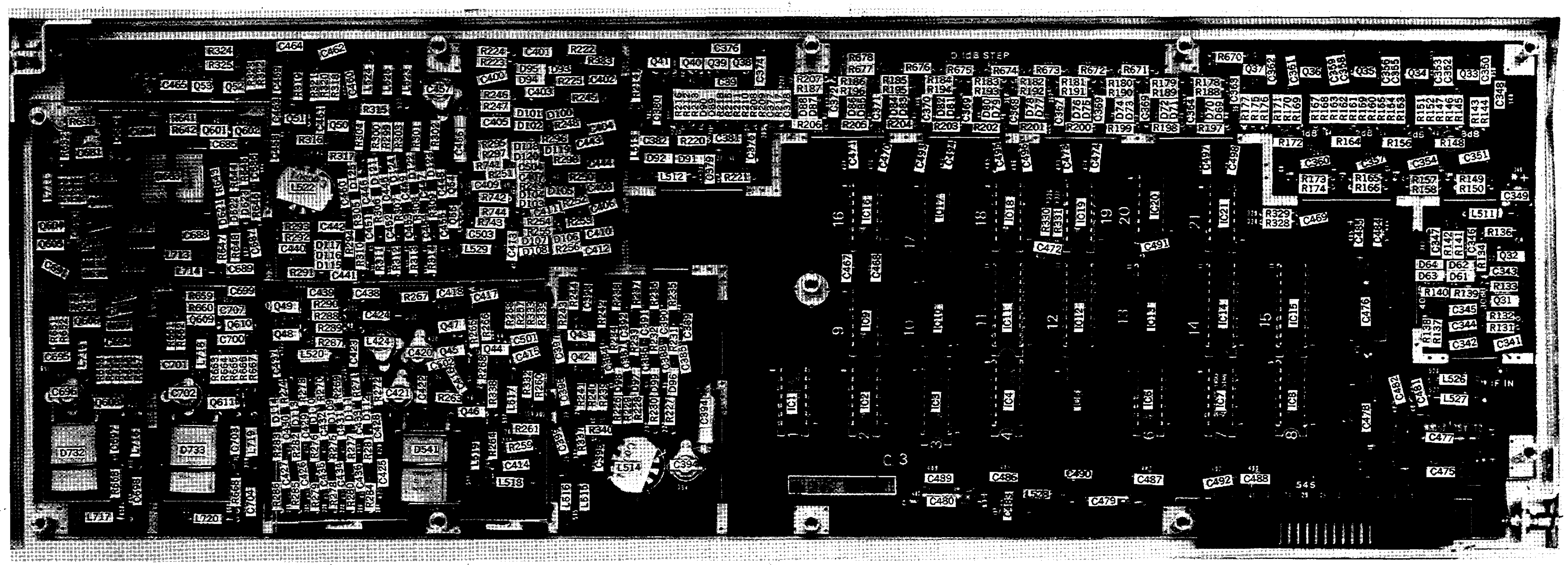
TR4172 Parts Allocations - 20



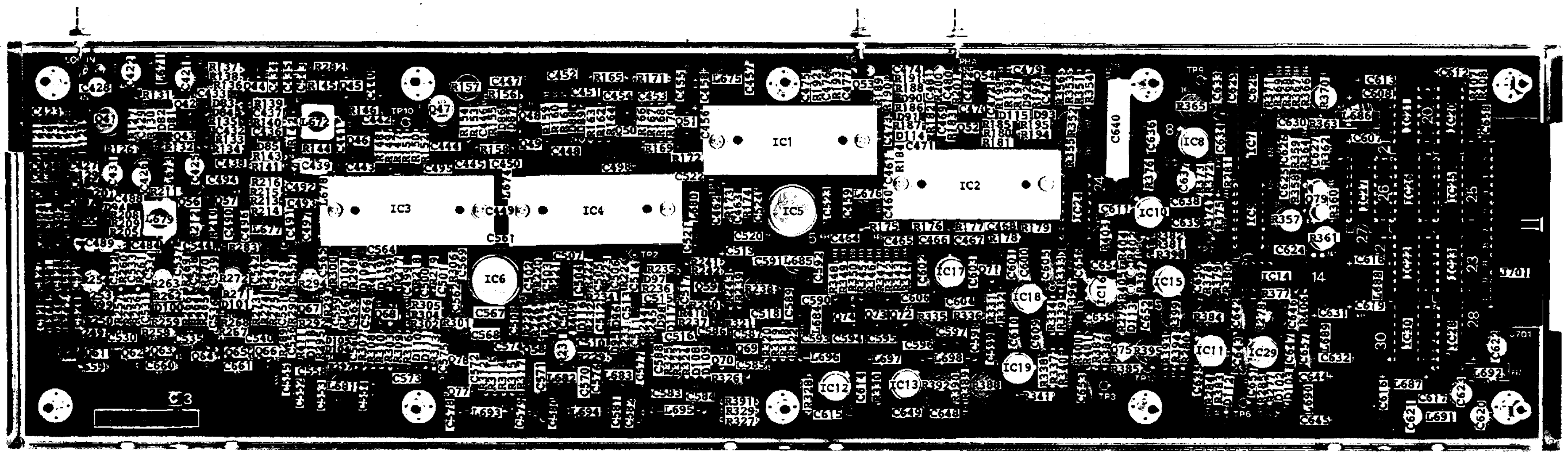
TR4172 Parts Allocations – 21



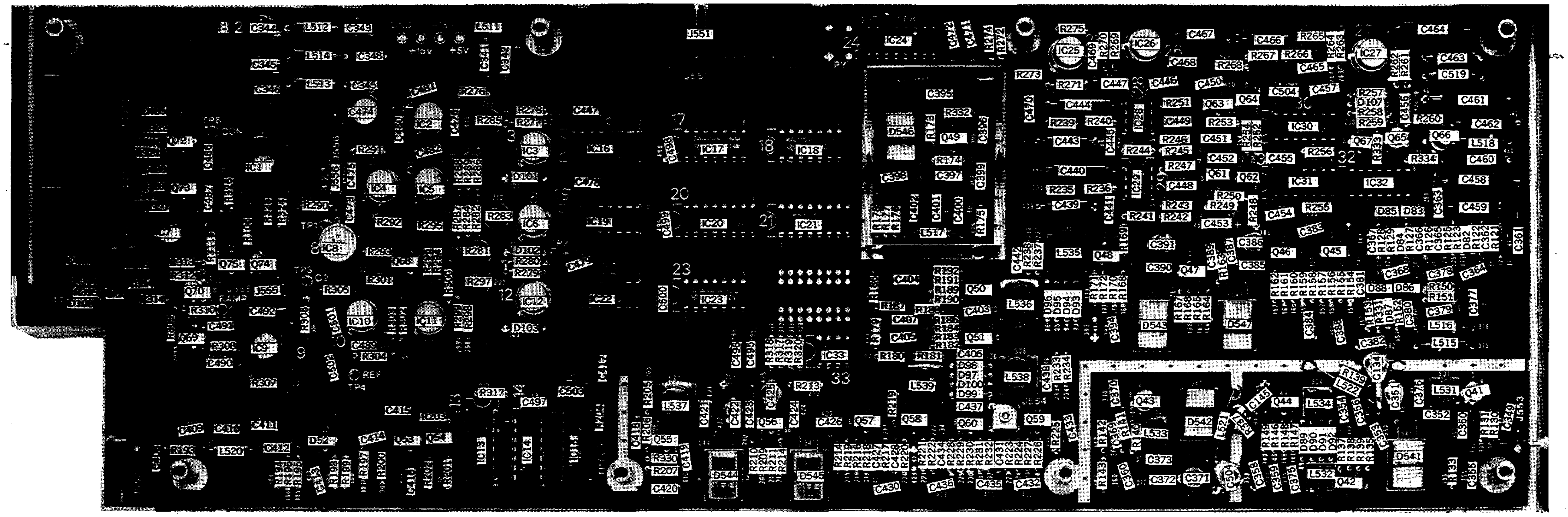
TR4172 Parts Allocations - 22



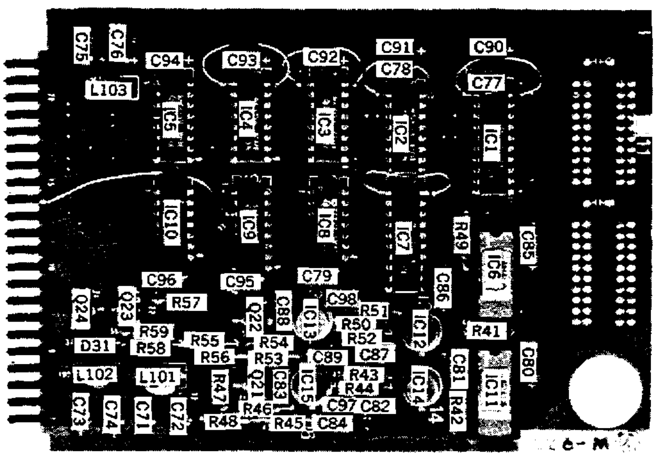
TR4172 Parts Allocations - 23



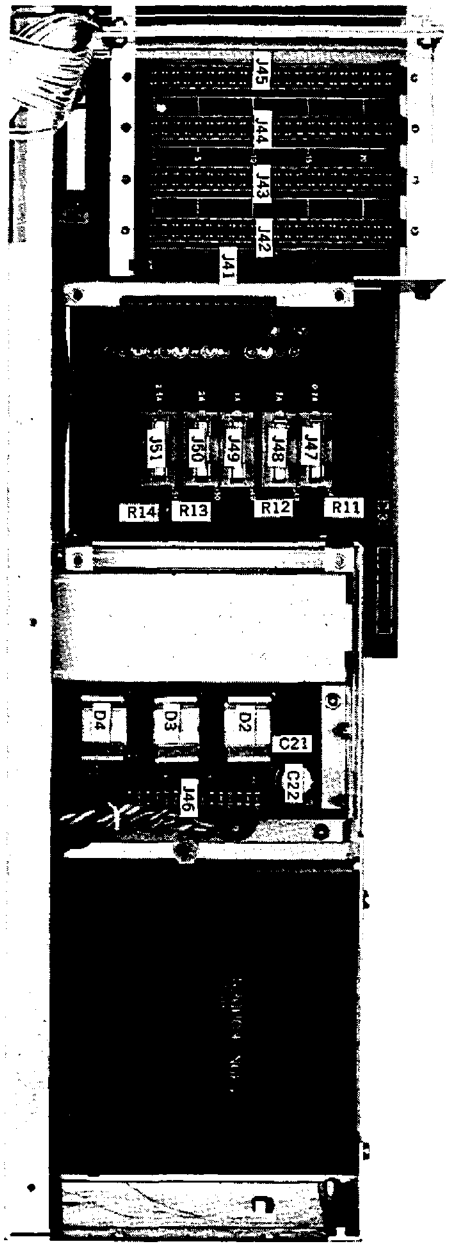
TR4172 Parts Allocations - 24



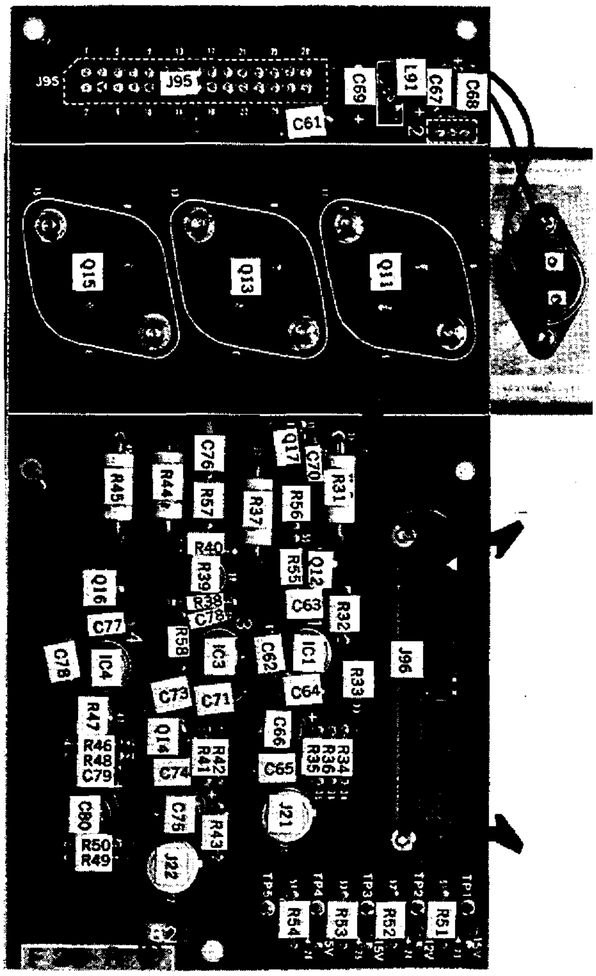
TR4172 Parts Allocations - 25



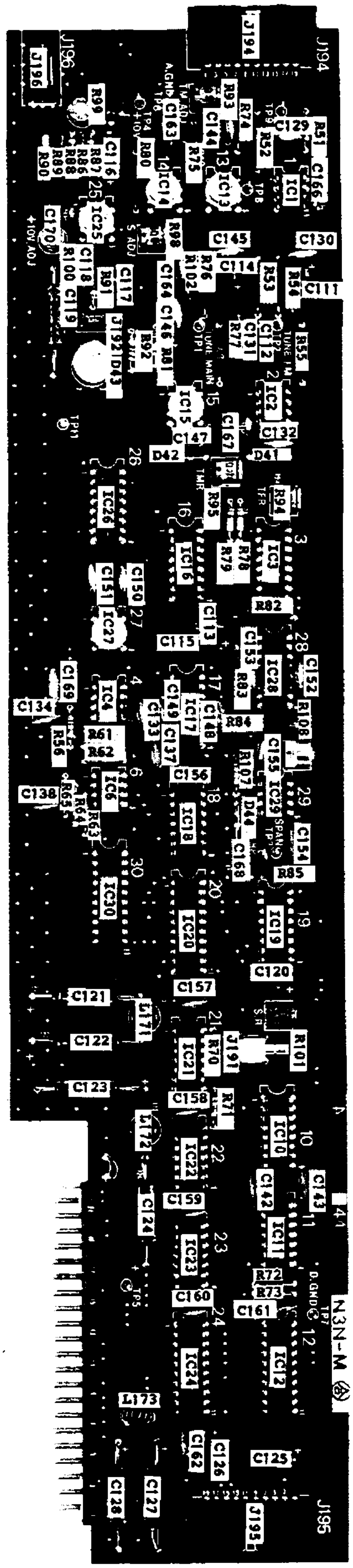
TR4172 Parts Allocations - 26



TR4172 Parts Allocations - 27



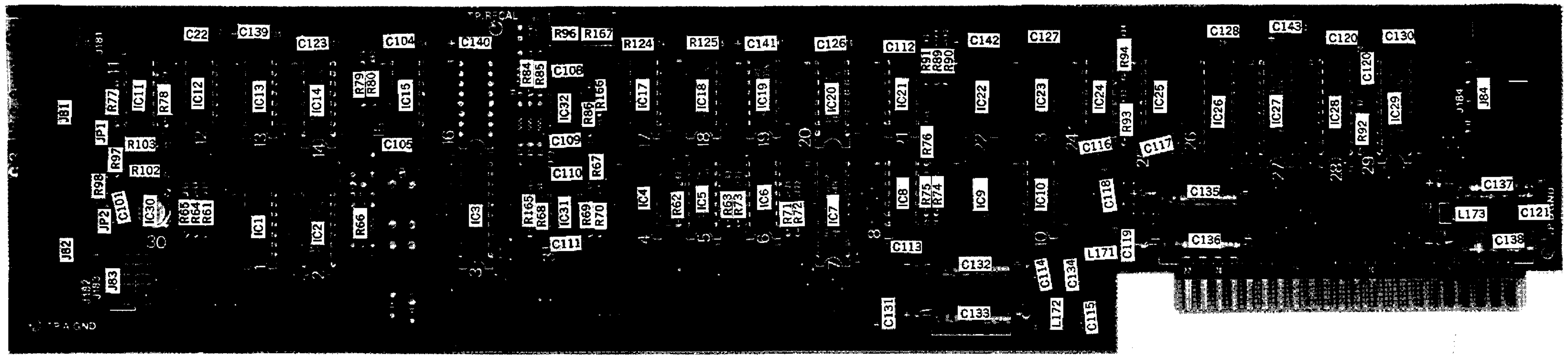
TR4172 Parts Allocations - 28



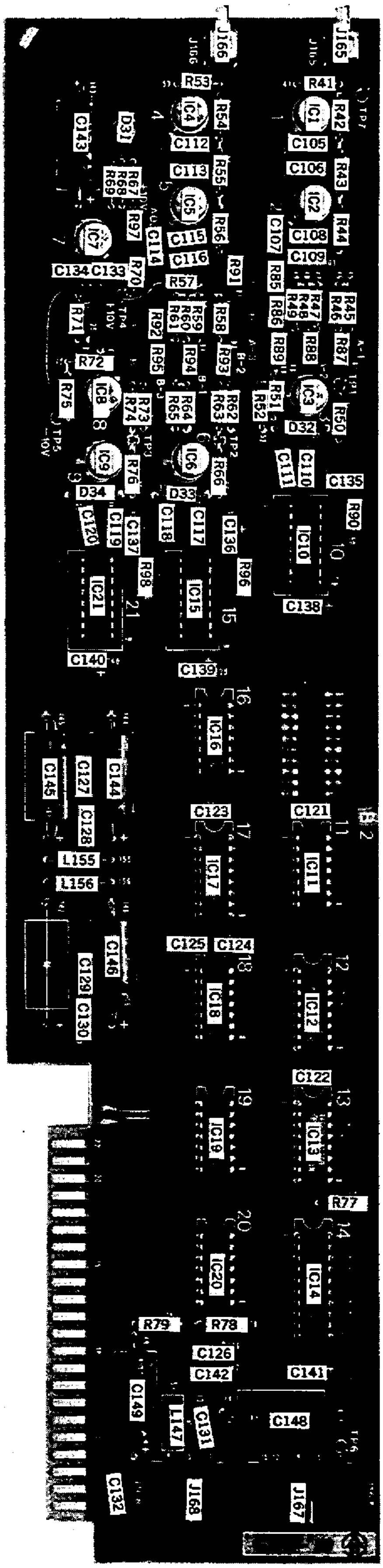
TR4172 Parts Allocations - 29

~~YIG OSCILLATOR I/O BGN-010219~~

29



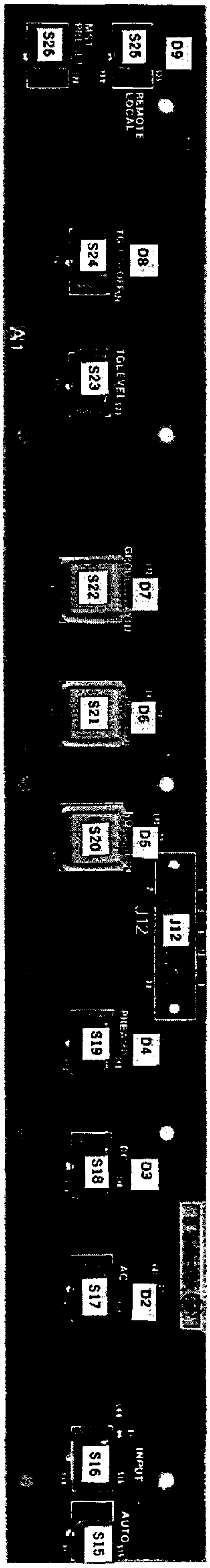
TR4172 Parts Allocations - 30



TR4172 Parts Allocations - 31

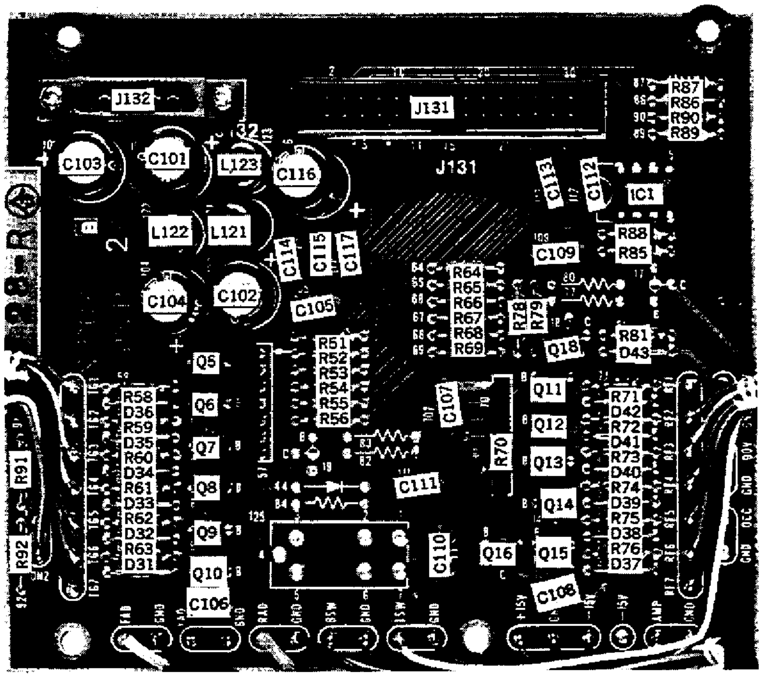
~~3rd LOCAL I/O BGN-010221~~

31



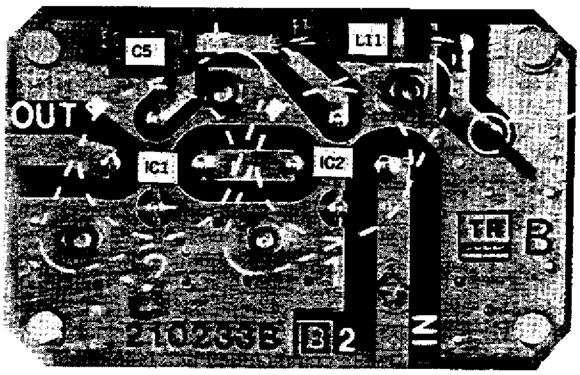
TR4172 Parts Allocations - 32

~~RF KEY BLN-010222~~



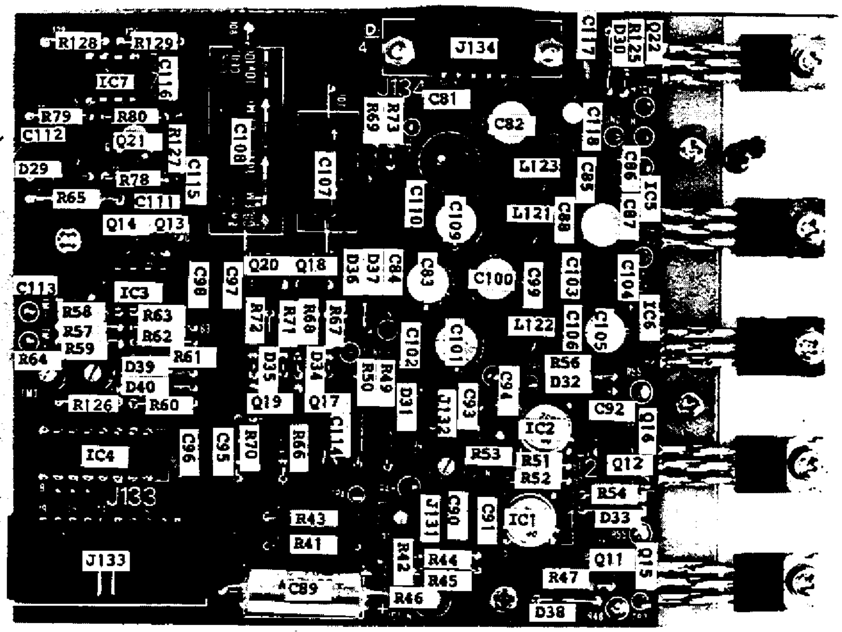
ATTENUATOR DRIVER
BLB-010223

TR4172 Parts Allocations - 33

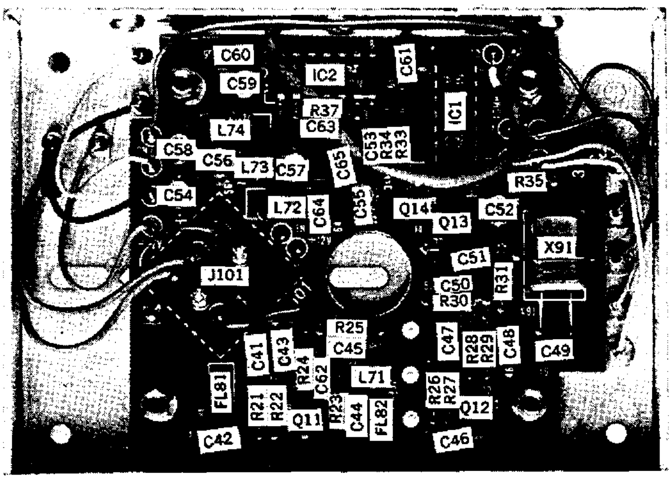


PREAMPLIFIER -010233

TR4172 Parts Allocations - 34

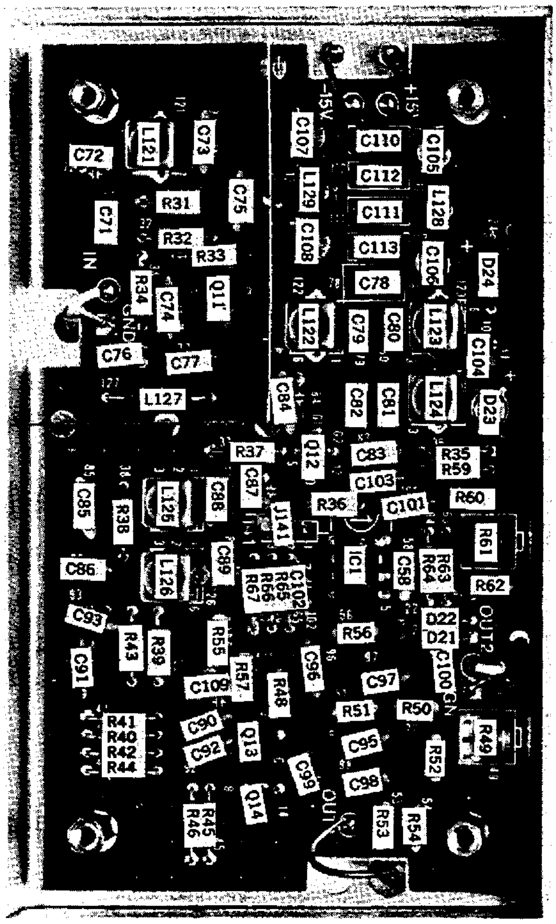


TR4172 Parts Allocations - 35



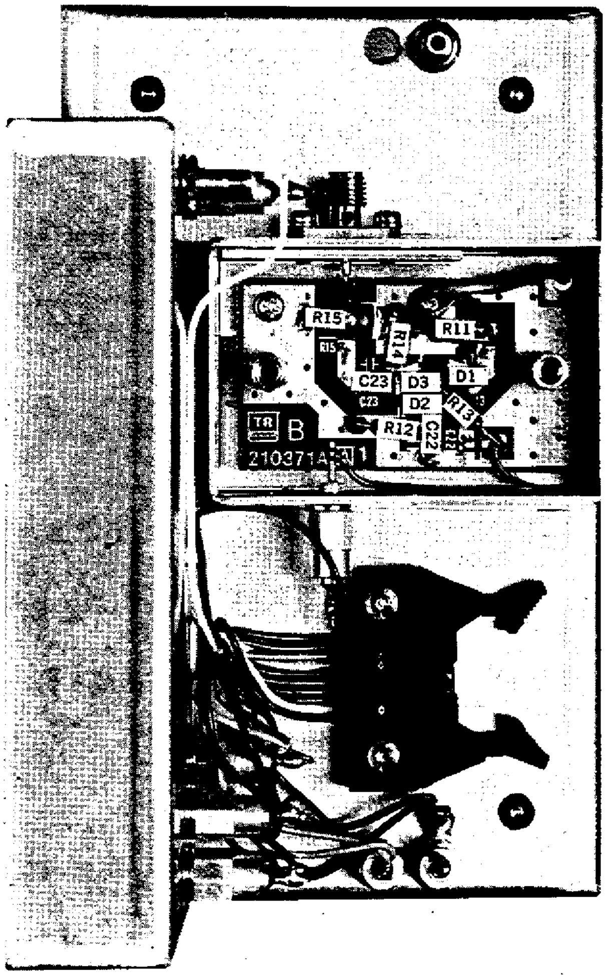
IME BASE B-010134

TR4172 Parts Allocations - 36



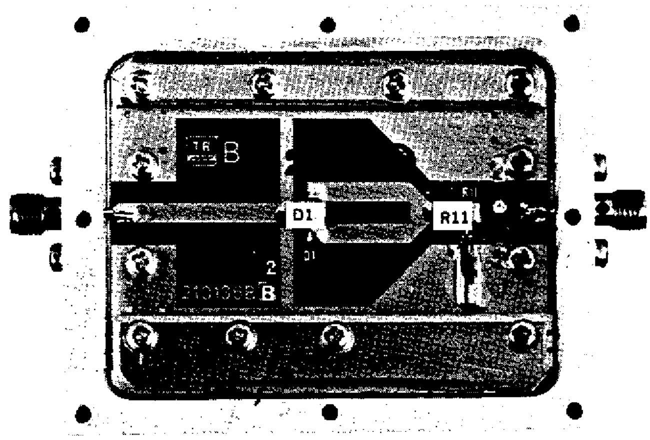
50 MHz STANDARD
BLB-010135

TR4172 Parts Allocations - 37



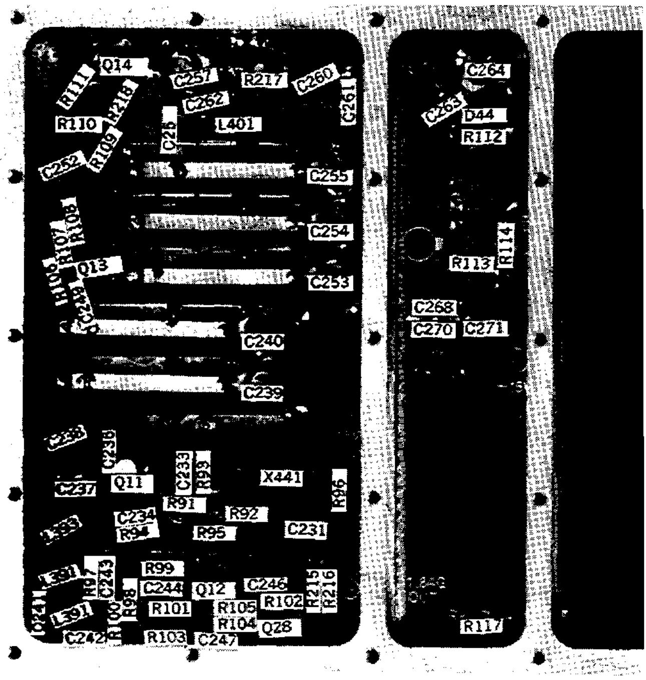
50 MHz STANDARD SWITCH
BLB-010371

TR4172 Parts Allocations - 38

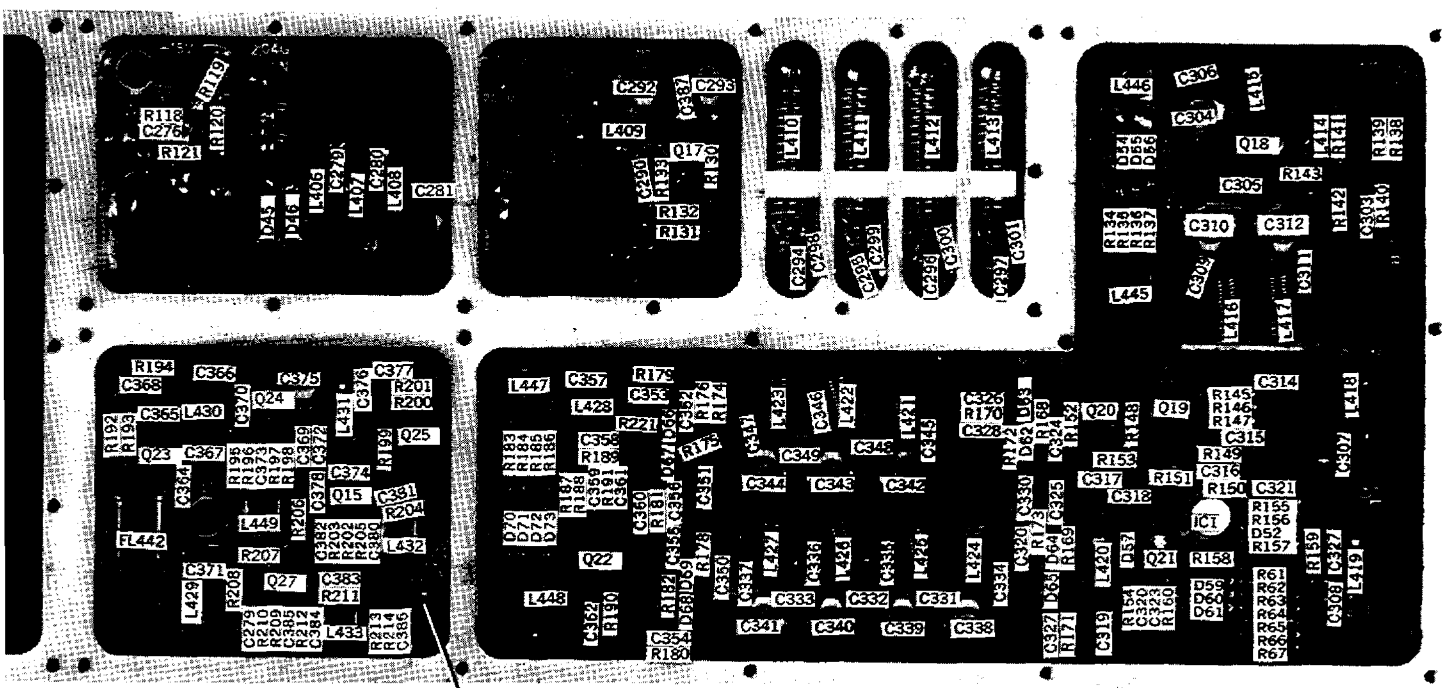


1st MIXER
BTB-010136

TR4172 Parts Allocations - 39

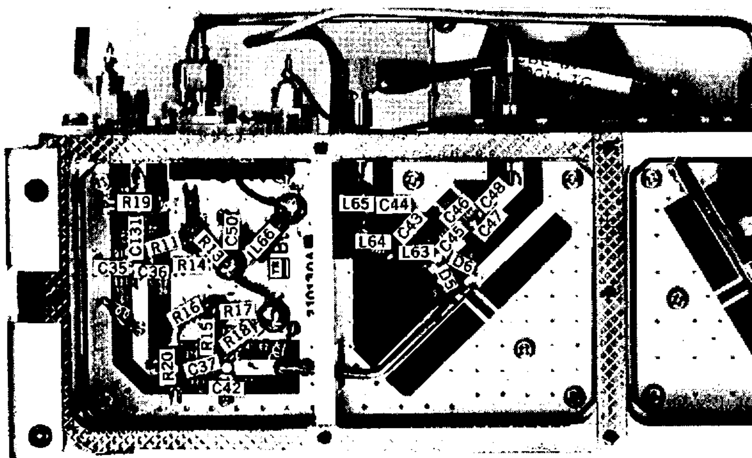


RF BLOCK MEP-345



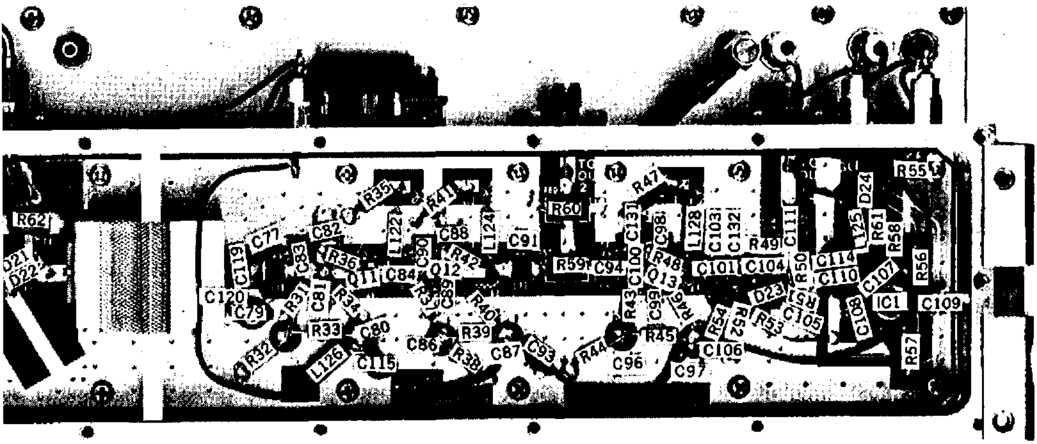
RF BLJ-010133

J24 (4th Local Osc. Output of 33.33 MHz)

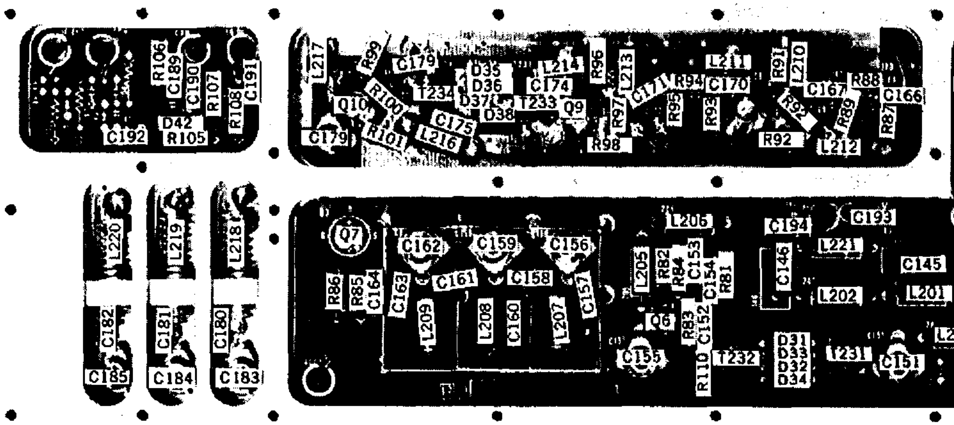


TRACKING GENERATOR-3

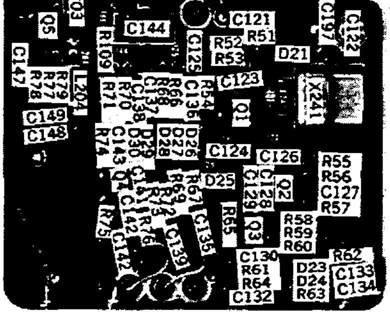
BTB-010130



TRACKING GENERATOR-1 | BTF-010128



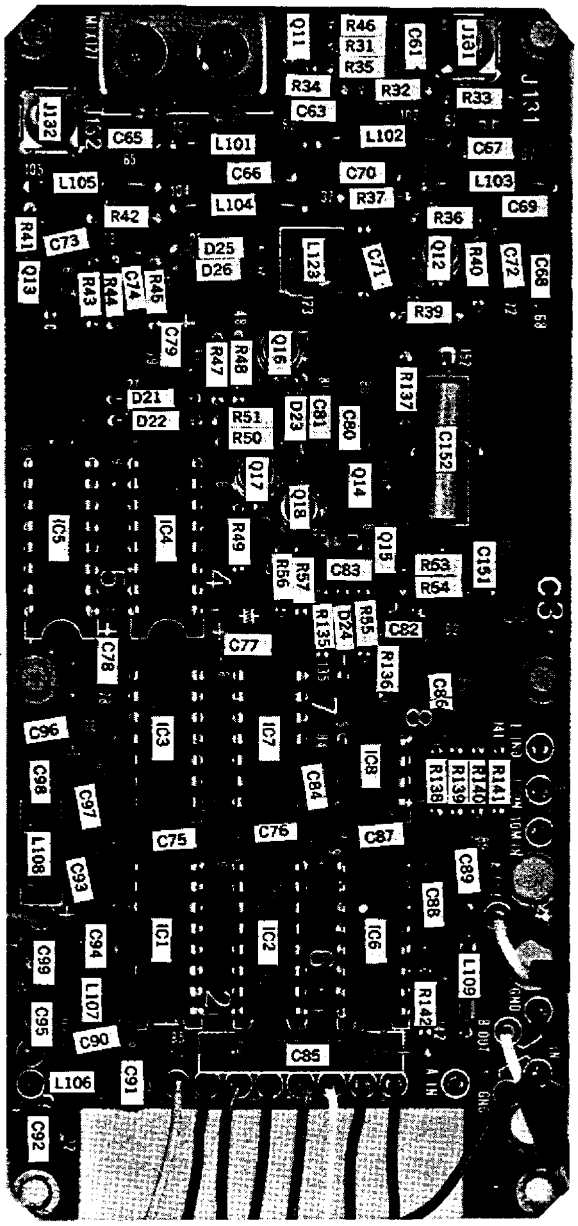
TRACKING GENERATOR-2 BLJ-010129



TR4172 Parts Allocations - 42

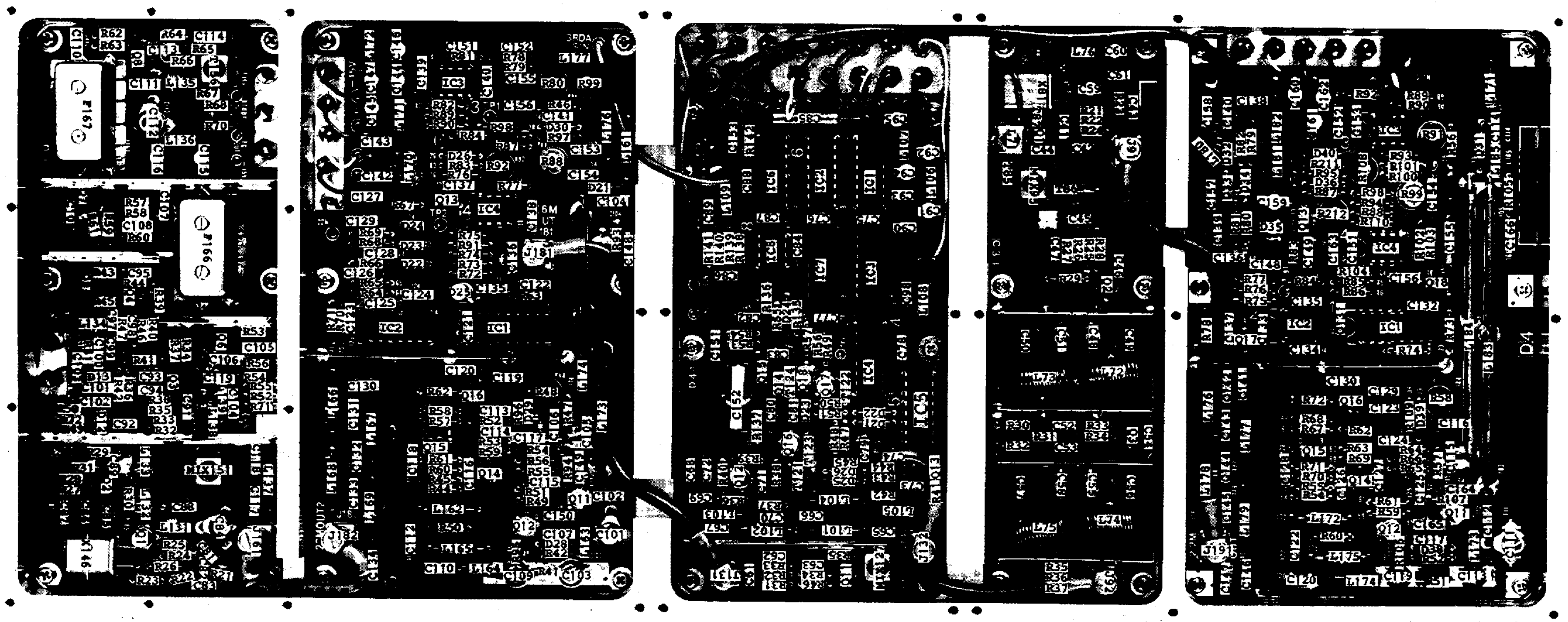
TRACKING GENERATOR BLOCK MEP-346

42

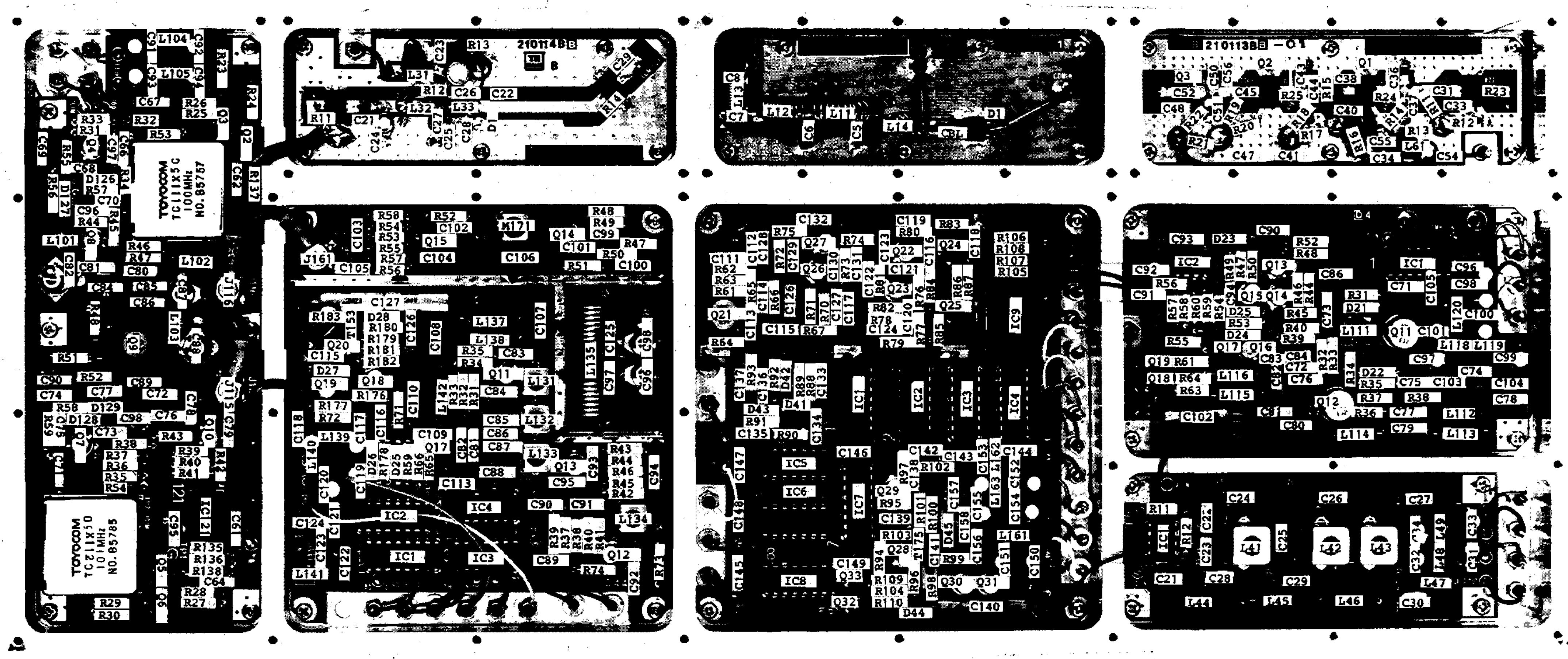


3rd LOCAL PLL
BLC-010103

TR4172 Parts Allocations - 43

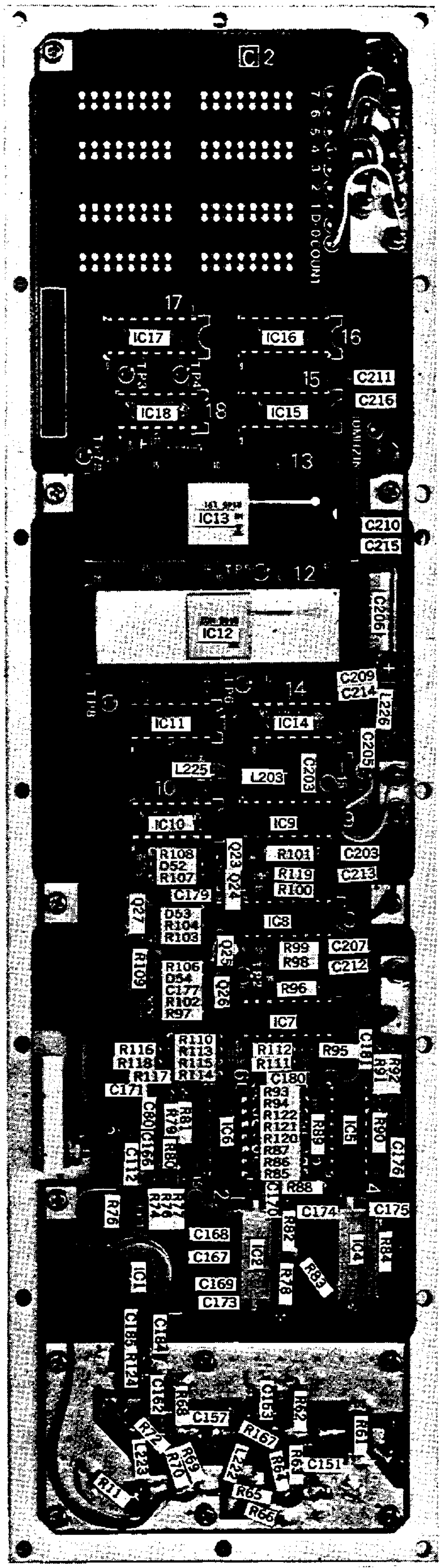


TR4172 Parts Allocations - 44



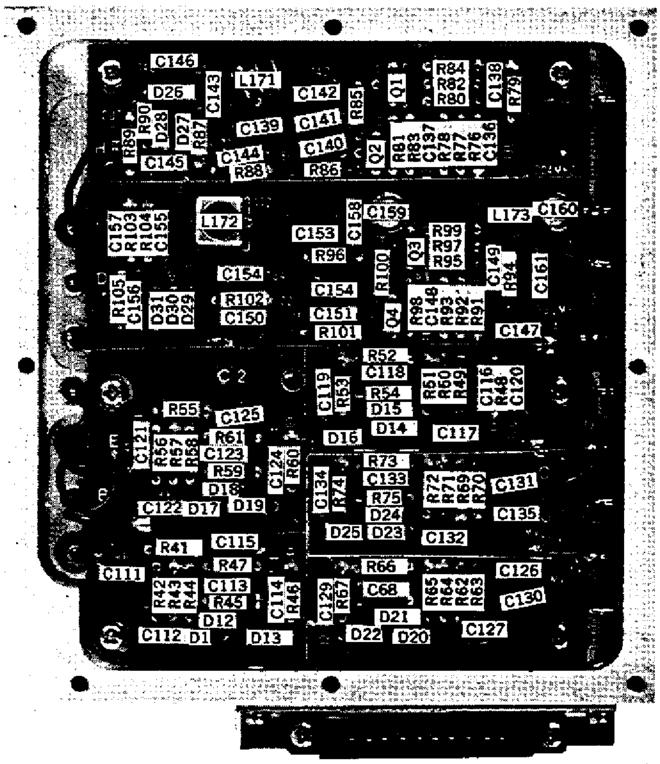
TR4172 Parts Allocations - 45

1st LOCAL PLL BLOCK MEP-348



TR4172 Parts Allocations - 46

COUNTER
BLJ-010131



COUNTER SWITCH   BLB-010505

TR4172 Parts Allocations - 47

TR4172
MECHANICAL PARTS LIST
DISPLAY SECTION
FRAME & CABINET ASSEMBLY

Fig. & INDEX No.	Stock No.	Description	Qty
14-1 1	MBS-18840A001B	PANEL, main	1
2	MHT-18789B	SUBPANEL, lower	1
3	MBT-18784B	BELT COVER, lower	1
4	MCT-10164B	4U SIDE COVER	2
5	MPX-15070A	BELT COVER, 4U side	2
6	MHT-18788B	SUBFRAME, upper	1
7	MMX-11091A	BELT COVER, upper	1
8	MBT-18743A	CRT PANEL, upper	1
9	MBS-18807A001A	CRT PANEL, lower	1
10	MCT-20335A	BEZEL, CRT	1
11	MPX-21621A	FILTER, CRT	1
12	MBX-20496B	COVER, bottom	1
13	MBX-18859B	COVER, top	1
14	MHT-18863D	FRAME A, side	1
15	MBX-10211A	PLATE, 4U side	4
16	MPX-10298A	COVER, side	1
17	MKT-18727A	FOOT, stack	2
18	MMX-10267B	FOOT, rear	2
19	MMX-10270A	HANDLE	1
20	MPX-18820A	COVER, side : front	1
21	MPX-18821A	COVER, side : rear	1
22	MHT-18862A	FRAME B, side	1
23	MKN-10442A	SPACER, handle	2
24	MKN-18729A	STOPPER	2
25	MHJ-18750A	HOLDER, MEP-337	1
26	MMK-20403A	FOOT	4

TR4172
MECHANICAL PARTS LIST
DISPLAY SECTION ASSEMBLY

Fig. & INDEX No.	Stock No.	Description	Qty
14-2 1	MBS-18842A001A	PANEL, Display Section rear	1
2	DMF-000488	FAN MOTOR	1
3	MBS-18841A001A	SUBPANEL, Display Section rear	1
4	MBZ-18813A	HOLDER A, heat sink	1
5	MBZ-18772A	HOLDER B, heat sink	1
6	MKJ-18855A	HEAT SINK	1
7	MBZ-18751A	PLATE, connector	1
8	JCB-AC044JX01	CONNECTOR (J4)	1
9	MBJ-18856A	HOLDER, thyristor	1
10	SEE-SF10DH1	THYRISTOR	1
11	LTP-000486	TRANSFORMER	1
12	MBJ-18861A	FRAME A	1
13	MBJ-18865A	FRAME B	1
14	MBJ-18791A	FRAME C	1
15	MBJ-18864A	FRAME D	1
16	YEE-000151	SUPPORTER, circuit board	18
17	MKZ-10311A	SPACER BOLT	1
18	MKJ-18746A	SUPPORTER A, connector	2
19	MKJ-18747A	SUPPORTER B, connector	2
20	JCB-AC056JX02	CONNECTOR (J41 to J57)	17
21	MHJ-18748A	SUPPORTER, circuit board	1
22	MBJ-18839A	COVER, circuit boards	1

TR4172
MECHANICAL PARTS LIST
CRT & SHIELD ASSEMBLY

Fig. & INDEX No.	Stock No.	Description	Qty
14-3 1	NCR-000169	CRT	1
2	MBX-21623A	CRT BAND (Upper)	1
3	MBX-21622A	CRT BAND (Lower)	1
4	ZTA-000123	TAPE	1
5	MKJ-18873A	FRAME, CRT	1
6	MBJ-18749A	HOLDER, VR	1
7	JTF-AF001EX02	TERMINAL	1
8	RVR-BL5K	VR (R4)	1
9	RVR-BA5K	VR (R3)	1
10	RVR-BA2K	VR (R2)	1
11	RVR-BL2K	VR (R1)	1
12	DCB-9S0495	CONNECTOR (J5)	1
13	DCB-9S0481	CONNECTOR (J6)	1
14	MBX-18879A	SHIELD CASE, CRT	1
15	MBX-18770A	CLAMP	1
16	ZTB-000022	TUBE	1
17	LCL-E00474	COIL, CRT	1
18	YEE-000070	GROMMET A	1
19	MPX-18766A	CUSHION, CRT neck, sponge	1
20	MPX-18767A	FILM, mylar	1
21	MBJ-18812B	COVER, HV bottom	1
22	MBJ-18860C	CASE, HV	1
23	MBJ-18811C	COVER, HV top	1
24	MBJ-18854A	HOLDER, HV	1
25	YEE-000068	GROMMET B	2
26	MKN-12974A	SPACER BOLT	1

TR4172
MECHANICAL PARTS LIST
DISPLAY KEY BLOCK
MEP-354 ASSEMBLY

Fig. & INDEX No.	Stock No.	Description	Qty
14-4 1	MBS-18840A001B	PANEL, Display Section main	1
2	MEE-20313A	KNOB, DATA	1
3	MMX-10278A	ACRYLATE, LED	1
4	MKX-18715A	SHAFT, knob	1
5	MKX-18731A	HOLDER, encoder	1
6	MKX-18718A	JOINT	1
7	MKX-18714A	COUPLING	1
8	RE20	ENCODER	1

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TR4172
MECHANICAL PARTS LIST
DISPLAY SECTION
REAR PANEL ASSEMBLY

Fig. & INDEX No.	Stock No.	Description	Qty
14-5 1	YEE-000268	GUARD A, fan motor	1
2	MBS-18842A001A	PANEL, Display Section	1
3	MBT-18732A	GUARD B, fan motor	1
4	MBJ-18781A	PLATE A, connector	1
5	JCS-AC024JX03	CONNECTOR, GPIB	1
6	MPX-16113A	BLANK PLATE	2
7	DMF-000488	FAN MOTOR	1
8	MBZ-18710A	HOLDER, fan motor	2
9	YEE-000524	RUBBER, vibration-proof	4
10	JCD-AA003PX01	CONNECTOR (J1)	1
11	MBJ-18709A	PLATE B, connector	1

TR4172
MECHANICAL PARTS LIST
DISPLAY SECTION
REAR SUBPANEL ASSEMBLY

Fig. & INDEX No.		Stock No.	Description	Qty
14-6	1	MBS-18796C	HOLDER, BNC connector	1
	2	YEE-000234	SPACER BOLT	2
	3	JCS-AE004AX02	CONNECTOR (J2)	1
	4	JCF-AB001JX02	CONNECTOR, BNC (J3, J15, J14, J13)	4
	5	MHJ-18711A	HOLDER, rear panel	4
	6	MBZ-18794A	HOLDER, transformer	1
	7	JCP-AX002JX01	CONNECTOR, plug socket (J3)	1
	8	MBS-18841A001A	SUBPANEL, Display Section rear	1
	9	MBZ-18813A	HOLDER, heat sink	1
	10	MBZ-18724A	GUIDE, circuit board	1
	11	JTE-AG001EX01	TERMINAL, GND	1
	12	JCD-AA003PX01	CONNECTOR (J1)	1

TR4172
MECHANICAL PARTS LIST
LOG BLOCK MEP-337 ASSEMBLY

Fig. & INDEX No.		Stock No.	Description	Qty
14-7	1	MBJ-18870B	SHIELD CASE, MEP-337	1
	2	MBS-19001B001B	COVER, MEP-337	1
	3	JCF-AC001JX02-2	CONNECTOR (J1, J2, J3)	3
	4	MKN-12967A	SPACER	10

TR4172
MECHANICAL PARTS LIST
IF BLOCK MEP-338 ASSEMBLY

Fig. & INDEX No.		Stock No.	Description	Qty
14-8	1	MBS-19003C001B	COVER A, MEP-338	1
	2	MBJ-18878B	SHIELD CASE, MEP-338	1
	3	MBS-19002C001B	COVER B, MEP-338	1
	4	MKN-10434A	SPACER BOLT	22
	5	MKJ-18778A	HOLDER, connector	1
	6	JCF-AB001JX11-2	CONNECTOR (J14)	1
	7	MBZ-18716A	COVER, holder	1
	8	JCF-AC001JX02-2	CONNECTOR (J11, J12, J13)	1

TR4172
MECHANICAL PARTS LIST
PHASE BLOCK MEP-339 ASSEMBLY

Fig. & INDEX No.	Stock No.	Description	Qty
14-9 1	MBS-18890A001A	COVER, MEP-339	1
2	MKN-12967A	SPACER BOLT	11
3	MBJ-18877A	CASE, MEP-339	1
4	JCF-AC001JX02	CONNECTOR	2

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TR4172
MECHANICAL PARTS LIST
RF SECTION
FRAME & CABINET ASSEMBLY

Fig. & INDEX No.	Stock No.	Description	Qty
14-10 1	MBS-18843B001B	PANEL, main	1
2	MHT-18801A	SUBFRAME, upper	1
3	MHT-18801B	SUBFRAME, lower	1
4	MPX-18822A	BELT COVER, upper	1
5	MPX-15074A	BELT COVER, lower	1
6	MCT-10162B	3U SIDE CORNER	2
7	MPX-15069A	BELT COVER, 3U side	2
8	MPX-10298A	COVER, side	1
9	MBX-11042A	PLATE, 3U side	4
10	MHT-18871A	FRAME A, side	1
11	MKJ-18798B	SUPPORTER, subpanel	1
12	MBJ-19534A	SUBPANEL, front	1
13	MMX-10270A	HANDLE	1
14	MPX-18820A	COVER, side : front	1
15	MPX-18821A	COVER, side : rear	1
16	MBX-18857B	COVER, top	1
17	MBX-18858B	COVER, bottom	1
18	MHT-18872A	FRAME B, side	1
19	MBJ-18815A	HOLDER, circuit board	1
20	MKT-18730B	STOPPER	2
21	MMX-11092A	FOOT, stack	2
22	MMX-20403A	FOOT	6
23	MMX-10267B	FOOT, rear	2
24	MKT-18726B	FOOT, stack : rear	2
25	MKN-18728A	LOCK BOLT	2
26	YEE-000382	CAP	2
27	MBS-18844B001A	SUBPANEL, rear	1
28	MBS-18845A001A	PANEL, rear	1

TR4172
MECHANICAL PARTS LIST
RF SECTION ASSEMBLY

Fig. & INDEX No.	Stock No.	Description	Qty
14-11 1	MBS-18845B001C	PANEL, RF Section rear	1
2	YEE-000271	GUARD, fan motor	1
3	YEE-000524	RUBBER, vibration-proof	2
4	MBZ-18713B	HOLDER, fan motor	2
5	DMF-000487	FAN MOTOR	1
6	MBX-19737A	SHIELD CASE, fan motor	1
7	JCP-AX002PX01	CONNECTOR (J95)	1
8	YEE-000234	SPACER BOLT	2
9	JCP-AX002JX01	CONNECTOR (J2)	1
10	JCP-AA003PX01	CONNECTOR (FL1)	1
11	MBJ-18797B	HOLDER, AC connector	1
12	SEE-SW1DM1	THYRISTOR (D1)	1
13	MBJ-18712A	HOLDER, thyristor	1
14	JCP-AX002JX01	CONNECTOR (J94)	1
15	MBJ-18717B	HOLDER, transformer	1
16	MHJ-18711A	HOLDER, RF rear panel	4
17	MBS-18844B001A	SUBPANEL, RF Section rear	1
18	DCB-RS0922X01	CONNECTOR (J1)	1
19	JTE-AG001EX01	TERMINAL, GND	1
20	CBL43	CONNECTOR (J3)	1
21	CBL44	CONNECTOR (J4)	1
22	LTP-000487	TRANSFORMER	1
23	JCB-AD30JX01	CONNECTOR (J93)	1
24	MBJ-18787A	HEAT SINK A	1
25	MBJ-18722A	HEAT SINK B	1
26	MKN-12037A	SPACER	1
27	MBZ-18869B	FRAME, power block	1
28	MBZ-18721A	HOLDER A	1
29	MBZ-18808A	HOLDER B	1
30	MHJ-18720A	HOLDER C	1

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TR4172
MECHANICAL PARTS LIST
RF SECTION ASSEMBLY

Fig. & INDEX No.	Stock No.	Description	Qty
14-11 31	MBJ-18719A	HOLDER D	1
32	JCB-AC044JX02-2	CONNECTOR (J42 to J45)	4

TR4172
MECHANICAL PARTS LIST
RF CHASSIS ASSEMBLY

Fig. & INDEX No.	Stock No.	Description	Qty
14-12 1	MBJ-18867C	CHASSIS, RF	1
2	MPX-18776A	SUPPORTER A, circuit board	1
3	MPX-18775A	SUPPORTER B, circuit board	2
4	MKN-12961A	SPACER A	2
5	DCB-RR0927X01	CONNECTOR	1
6	MHJ-18800A	SUPPORTER, RF chassis	2
7	YEE-000639	RUBBER, vibration-proof	1
8	MKN-12024A	SPACER B	1

TR4172
MECHANICAL PARTS LIST
MEP-340 MEP-351 ASSEMBLY

Fig. & INDEX No.	Stock No.	Description	Qty
14-13 1	MBJ-19534A	SUBPANEL, RF Section front	1
2	JTT-AA005EX01	LUG A, tight	1
3	JCS-AV004JX01	CONNECTOR (J7)	1
4	CBL15	CABLE with connector	1
5	JCF-AA001JX07	CONNECTOR (J5)	1
6	RVR-BA10K	VR (R1)	1
7	MKJ-18798B	SUPPORTER, subpanel	1
8	RVR-BL10K	VR (R3)	1
9	MKN-12044A	SPACER A	2
10	JCF-AF001JX05	CONNECTOR (J6)	1
11	NLD-000002	LED (D15)	1
12	NLD-000001	LED (D16)	1
13	MMX-11094A	KNOB, power switch	1
14	MKN-12035A	SPACER B	2
15	KSP-000360	SWITCH, power	1
16	MBJ-18761B	COVER, MEP-351	1
17	DNF-000471	FILTER	1
18	JCF-AA001JX20-2	CONNECTOR (J77, J78)	2

TR4172
MECHANICAL PARTS LIST
YIG OSCILLATOR BLOCK
MEP-341 ASSEMBLY

Fig. & INDEX No.	Stock No.	Description	Qty
14-14 1	MBZ-28758A	HOLDER, YIG OSC	1
2	DXY-000498	YIG OSC	1
3	MKN-12037A	SPACER	1
4	MBJ-22189A	HOLDER,power amplifier	1
5	MKJ-22698B	HEAT SINK, YIGD	1

TR4172
MECHANICAL PARTS LIST
STANDARD FREQUENCY BLOCK
MEP-342 ASSEMBLY

Fig. & INDEX No.	Stock No.	Description	Qty
14-15 1	MBJ-18816A	COVER, 50MHz case	1
2	MKN-10434A	SPACER BOLT	8
3	MBJ-18817C	CASE, 50MHz	1
4	DNF-00601	FILTER	8
5	JCF-AC001JX02-2	CONNECTOR (J51 to J55)	5
6	DXC-000119/120-1	CRYSTAL	1
7	MBJ-18810D	CASE, TIME BASE	1
8	JCS-AD010PX05	CONNECTOR	1
9	MKN-12961A	SPACER	2
10	MBJ-18814B	COVER, TIME BASE case	1

TR4172
MECHANICAL PARTS LIST
1st MIXER BLOCK
MEP-343 ASSEMBLY

Fig. & INDEX No.	Stock No.	Description	Qty
14-16 1	MBJ-18737A	COVER, top	1
2	MKN-19054A	PLATE A, GND	1
3	MYN-19056A	SPRING A, GND	1
4	MKN-19053A	PLATE B, GND	1
5	MYM-19055A	SPRING B, GND	1
6	MKJ-19057B	CASE, MEP-343	1
7	MKJ-19058A	COVER, bottom	1
8	MBJ-18756A	HOLDER, MEP-343	1
9	JCF-AA001JX20-2	CONNECTOR (J10, J11, J12)	3

TR4172
MECHANICAL PARTS LIST
RF BLOCK MEP-345 ASSEMBLY

Fig. & INDEX No.	Stock No.	Description	Qty
14-17 1	MKJ-18846B	COVER, bottom MEP-345	1
2	DNF-000471	FILTER	10
3	JCF-AA001JX20-2	CONNECTOR (J18, J19, J20)	3
4	MBZ-18825A	HOLDER A, connector	1
5	JCR-AG010PX01	CONNECTOR (J29)	1
6	MBZ-18742A	HOLDER B, connector	1
7	JCS-AD005PX05	CONNECTOR (J28)	1
8	JCF-AC001JX02-2	CONNECTOR (J21 to J25)	1
9	MKJ-18875B	CASE, MEP-345	1
10	MBS-18999B001B	COVER A, top	1
11	MBS-18998B001B	COVER B, top	1
12	MBS-19000B001B	COVER C, top	1

TR4172
MECHANICAL PARTS LIST
TRACKING GENERATOR BLOCK
MEP-346 ASSEMBLY

Fig. & INDEX No.		Stock No.	Description	Qty
14-18	1	MBS-18833A001A	COVER A	1
	2	MBS-18834A001A	COVER B	1
	3	MBS-18837A001A	COVER C	1
	4	MKJ-18847A	CASE, top T.G.-2	1
	5	MKJ-18853B	CASE, bottom T.G.-2	1
	6	JCR-AG010PX01	CONNECTOR (J50)	1
	7	MBZ-18825A	HOLDER A, connector	1
	8	JCR-AG010PX01	CONNECTOR (J51)	1
	9	MBZ-18742A	HOLDER B, connector	1
	10	DNF-000471	FILTER	12
	11	JCF-AC001JX02-2	CONNECTOR (J34 to J40)	7
	12	MKJ-18849A	CASE, T.G.-1,3	1
	13	JCF-AA001JX20-2	CONNECTOR (J26 to J30)	5
	14	MKJ-18734A	SHIELD PLATE A	1
	15	MBS-18835A001A	COVER D	1
	16	MKJ-18733A	SHIELD PLATE B	1
	17	MKJ-18758A	SUPPORTER, T.G.-1	1
	18	MBS-18838A001A	COVER E	1
	19	MBJ-18735B	HOLDER A, MEP-346	1
	20	MBJ-18736A	HOLDER B, MEP-346	1
	21	BM4-8024250	HOLDER, THD-222	1
	22	MBJ-18805A	HOLDER C, MEP-346	1

TR4172
MECHANICAL PARTS LIST
3rd LOCAL BLOCK
MEP-347 ASSEMBLY

Fig. & INDEX No.	Stock No.	Description	Qty
14-19 1	MKJ-18850C-1	CASE, MEP-347	1
2	MBZ-18826A	HOLDER A, connector	1
3	JCR-AG016PX01	CONNECTOR (J101)	1
4	MBZ-18742A	HOLDER B, connector	1
5	JCS-AD005PX01	CONNECTOR (J100)	1
6	MBS-18887A001A	COVER A	1
7	MBS-18885C001C	COVER B	1
8	MBS-18888B001B	COVER C	1
9	MBS-18836A001A	COVER D	1
10	MBS-18886C001C	COVER E	1

TR4172
MECHANICAL PARTS LIST
1st LOCAL PLL BLOCK
MEP-348 ASSEMBLY (1)

Fig. & INDEX No.	Stock No.	Description	Qty
14-20 1	MKJ-18876B	CASE, MEP-348	1
2	MKJ-19741A	SUPPORTER, chassis	2
3	JCS-AD005PX05	CONNECTOR (J102)	1
4	JCR-AG020PX01	CONNECTOR (J101)	1
5	MBZ-18765A	HOLDER, connector	1
6	MBJ-19742A	CHASSIS, BPF	1
7	JCF-AA001JX20-2	CONNECTOR (J65, J66, J68 to J72)	7
8	DNF-000471	FILTER	33
9	JCF-AC001JX02-2	CONNECTOR (J61 to J64, J67, J91, J92)	7
10	MBZ-28759A	SUPPOTER, YIG	1
11	YEE-000786-1	SPACER BOLT	3
12	YEE-000639	RUBBER	4

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TR4172
MECHANICAL PARTS LIST
1st LOCAL PLL BLOCK
MEP-348 ASSEMBLY (2)

Fig. & INDEX No.	Stock No.	Description	Qty
14-21 1	MKJ-18876B	CASE, MEP-348	1
2	JCF-AA001JX20-2	CONNECTOR (J65, J66, J68 to J72)	7
3	DNF-000471	FILTER	33
4	JCF-AC001JX02-2	CONNECTOR (J61 to J64, J67, J91, J92)	7
5	MKJ-19741A	HOLDER, chassis	2
6	MBS-18881B001B	COVER A	1
7	MBS-18830A001A	COVER B	1
8	MBS-18832B001A	COVER C	1
9	MBS-18831B001A	COVER D	1
10	MBS-19543A001B	COVER E	1
11	MBS-19544A001A	COVER F	1
12	MBS-18882B001B	COVER G	1
13	MBS-18884A001A	COVER H	1

TR4172
MECHANICAL PARTS LIST
COUNTER BLOCK MEP-349 ASSEMBLY

Fig. & INDEX No.		Stock No.	Description	Qty
14-22	1	MKJ-18852D	COVER, bottom MEP-349	1
	2	JCF-AA001JX20	CONNECTOR (J42)	1
	3	DNF-000601	FILTER	3
	4	MBZ-18827A	HOLDER A, connector	1
	5	JCR-AG020PX01	CONNECTOR (J42)	1
	6	MBZ-18742A	HOLDER B, connector	1
	7	JCS-AD005PX05	CONNECTOR (J61)	1
	8	JTF-AB001EX04	TERMINAL	9
	9	JCF-AC001JX02-2	CONNECTOR (J41, J51)	2
	10	MKJ-18740A	HEAT SINK	1
	11	MKJ-18851B	COVER, top MEP-349	1

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TR4172
MECHANICAL PARTS LIST
COUNTER BLOCK MEP-400 ASSEMBLY

Fig. & INDEX No.	Stock No.	Description	Qty
14-23 1	MBS-18780B001A	COVER, MEP-400	1
2	MKJ-18823A	CASE, MEP-400	1
3	DNF-000601	FILTER	8
4	JCS-AD010PX05	CONNECTOR (J62)	1
5	MBZ-18777A	HOLDER, connector	1
6	JCF-AC001JX02-2	CONNECTOR (J43 to J50)	8

TR4172
MECHANICAL PARTS LIST
RF KEY BLOCK MEP-352 ASSEMBLY

Fig. & INDEX No.	Stock No.	Description	Qty
14-24 1	MBS-18843A001B	PANEL, RF Section main	1
2	MMX-10463A	KNOB, T.G. FREQ.	1
3	MMX-11093A	BEZEL, power switch	1
4	MMX-10278A	ACRYLATE, LED	10
5	JCR-AF020PX01	CONNECTOR (J12)	1

TR4172
LIST OF STOCK NUMBERS
OF MAIN PANEL KEYS

Fig. & INDEX No.	Stock No.	Description	Qty
14-25 1	MMX-18819C	KEY GROUP A (23 keys)	1
2	MMX-10276A	KEY GROUP B (8 keys)	1
3	MMX-10272A	KEY GROUP C (15 keys)	1
4	MMX-10274A	KEY GROUP D (15 keys)	1
5	MMX-10275A	KEY E	1
6	MMX-18066A	KEY F	1
7	MMS-18818B	KEY GROUP G (6 keys)	1

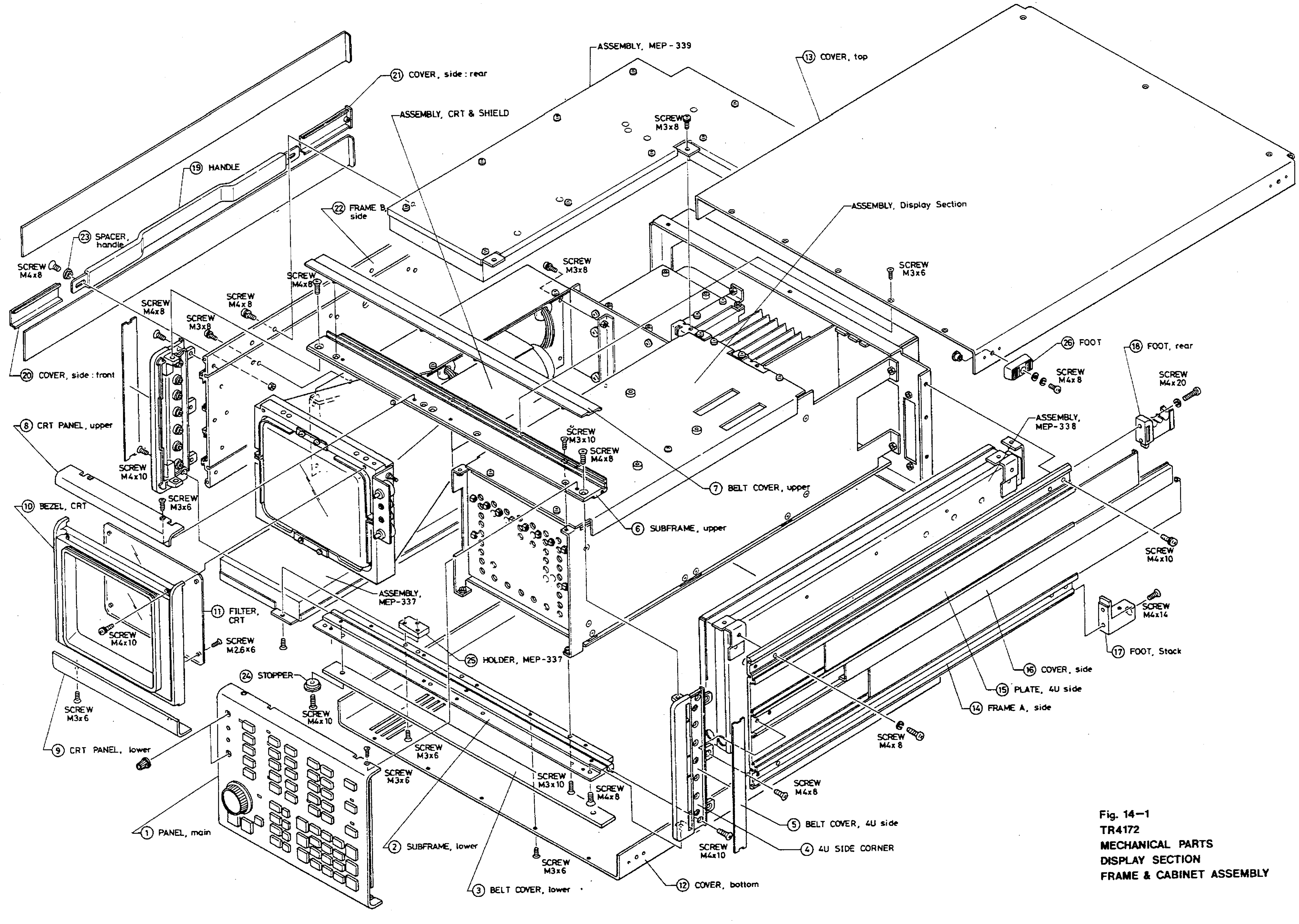


Fig. 14—1
TR4172
MECHANICAL PARTS
DISPLAY SECTION
FRAME & CABINET ASSEMBLY

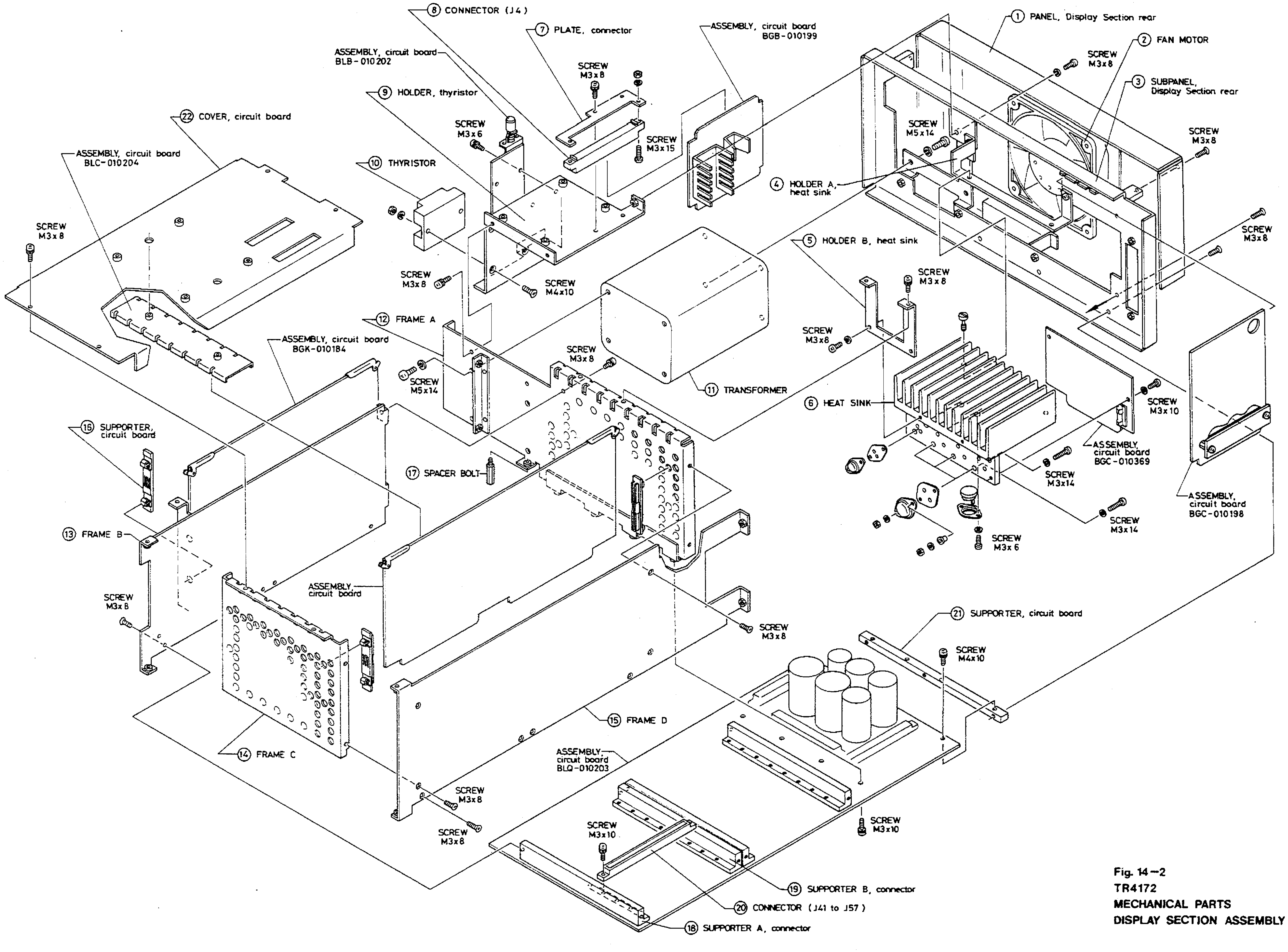


Fig. 14-2
TR4172
MECHANICAL PARTS
DISPLAY SECTION ASSEMBLY

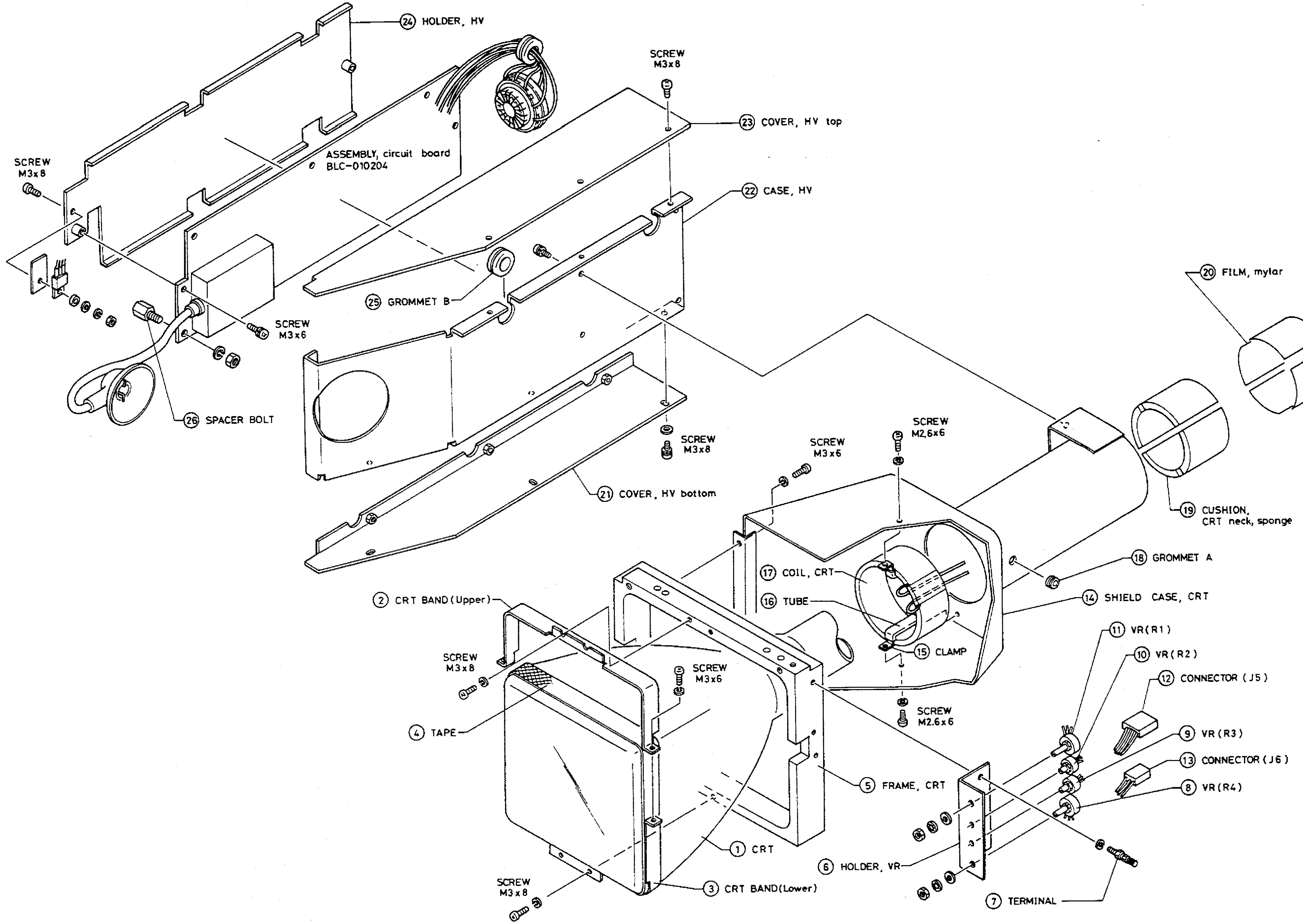


Fig. 14—3
TR4172
MECHANICAL PARTS
CRT & SHIELD ASSEMBLY

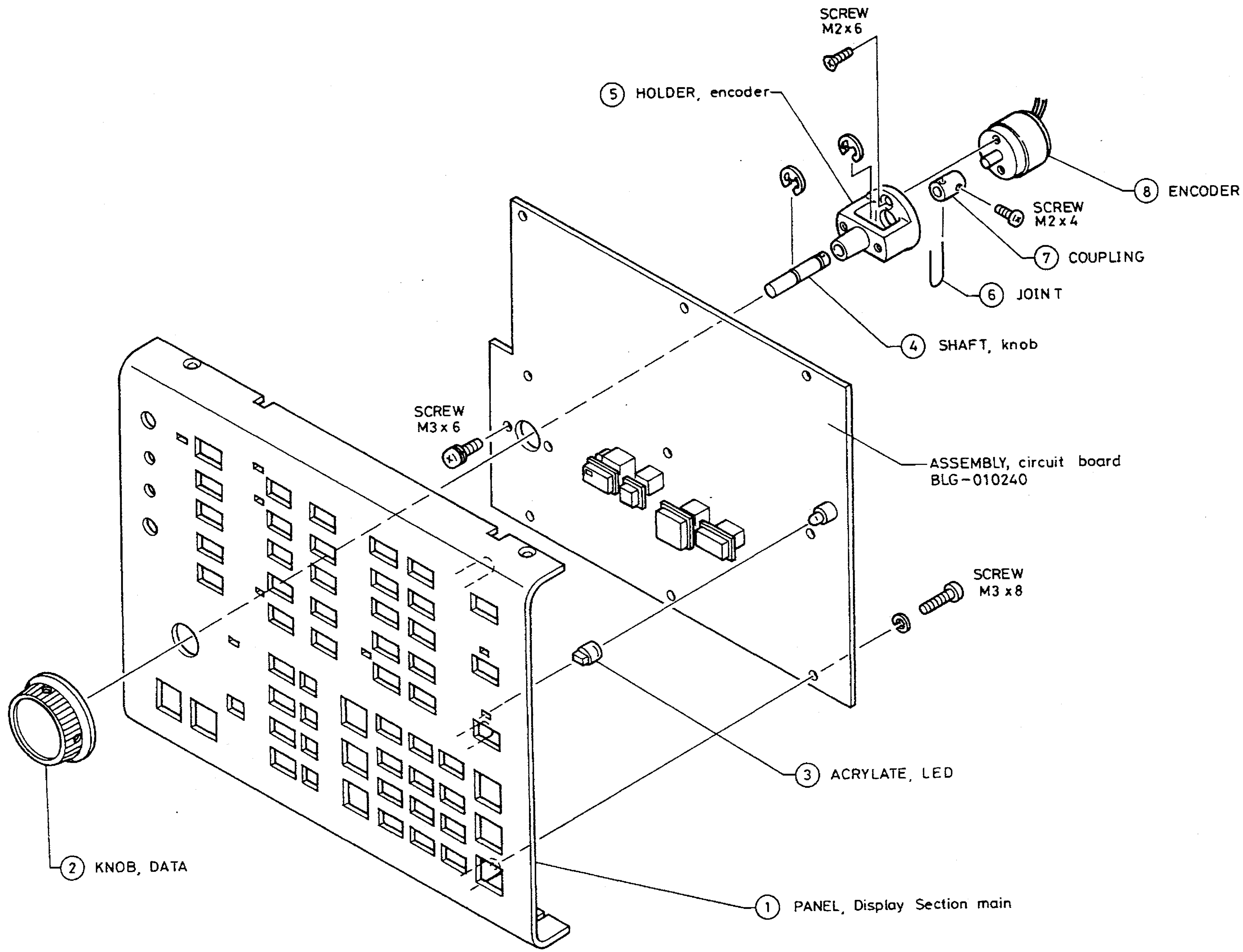


Fig. 14-4
TR4172
MECHANICAL PARTS
DISPLAY KEY BLOCK
MEP-354 ASSEMBLY

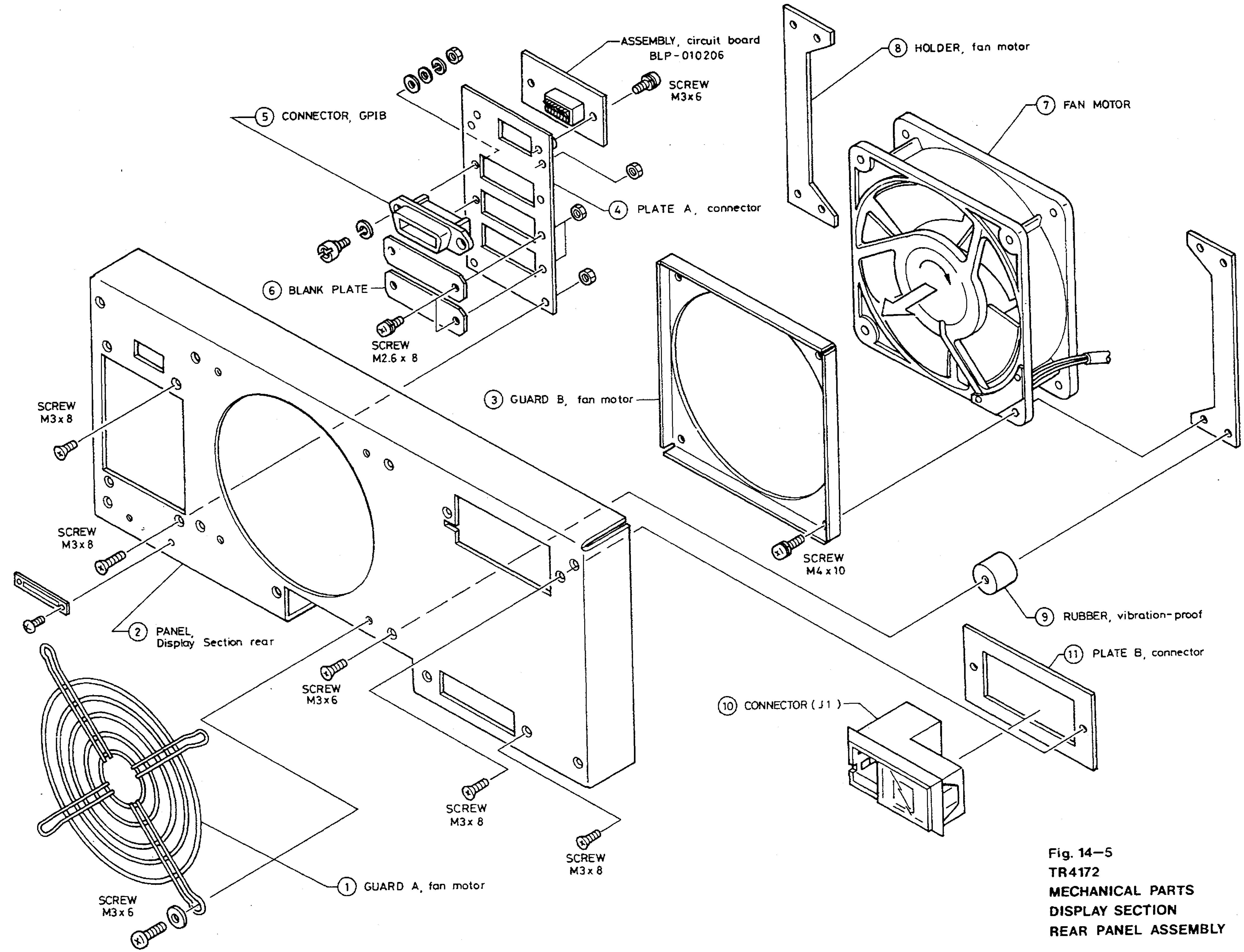
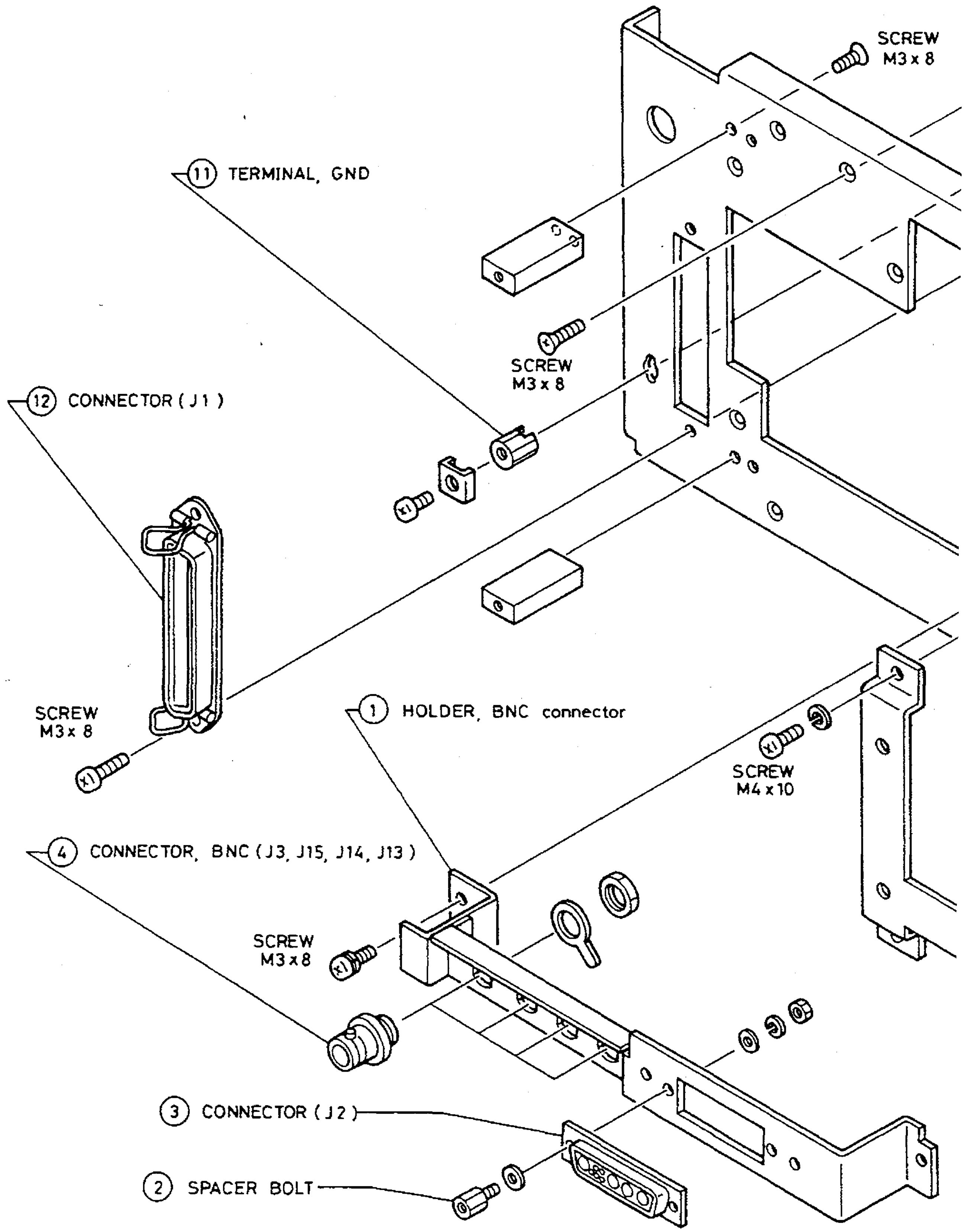


Fig. 14—5
TR4172
MECHANICAL PARTS
DISPLAY SECTION
REAR PANEL ASSEMBLY



SCREW
M3 x 8
11 TERMINAL, GND
SCREW
M3 x 8
12 CONNECTOR (J1)
SCREW
M3 x 8
1 HOLDER, BNC connector
SCREW
M4 x 10
4 CONNECTOR, BNC (J3, J15, J14, J13)
SCREW
M3 x 8
3 CONNECTOR (J2)
2 SPACER BOLT

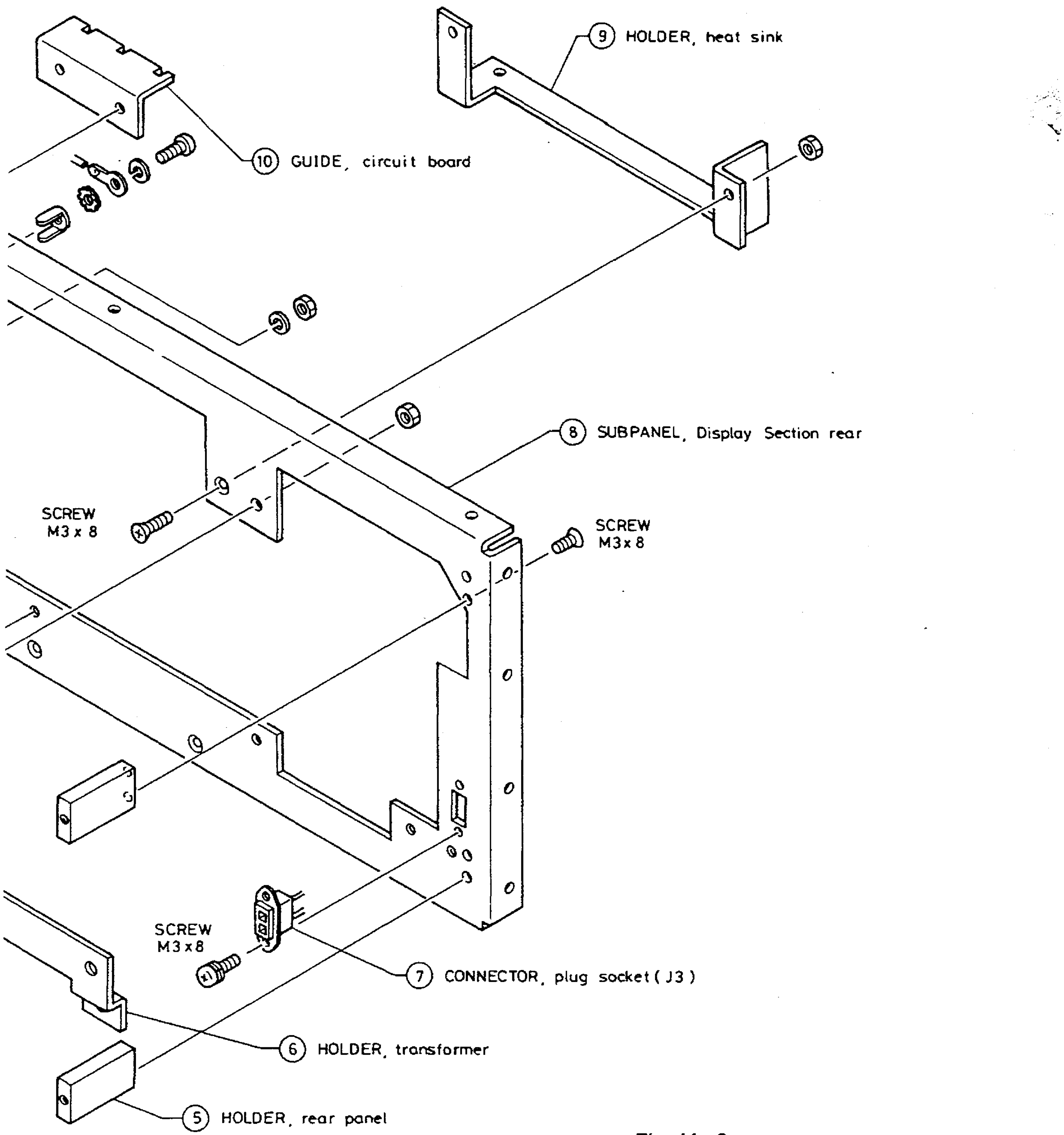
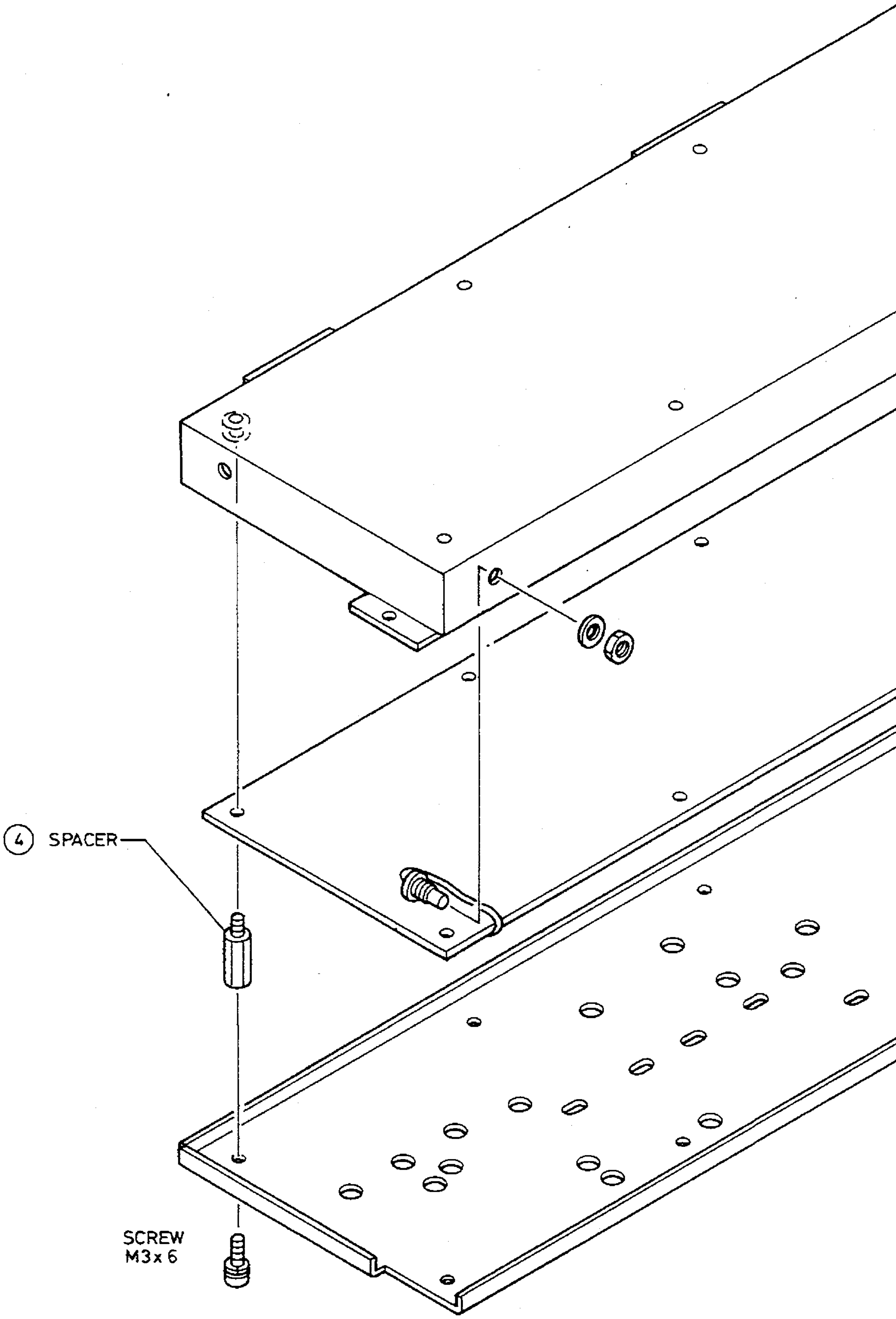


Fig. 14−6
TR4172
MECHANICAL PARTS
DISPLAY SECTION
REAR SUBPANEL ASSEMBLY



4 SPACER
SCREW
M3 x 6

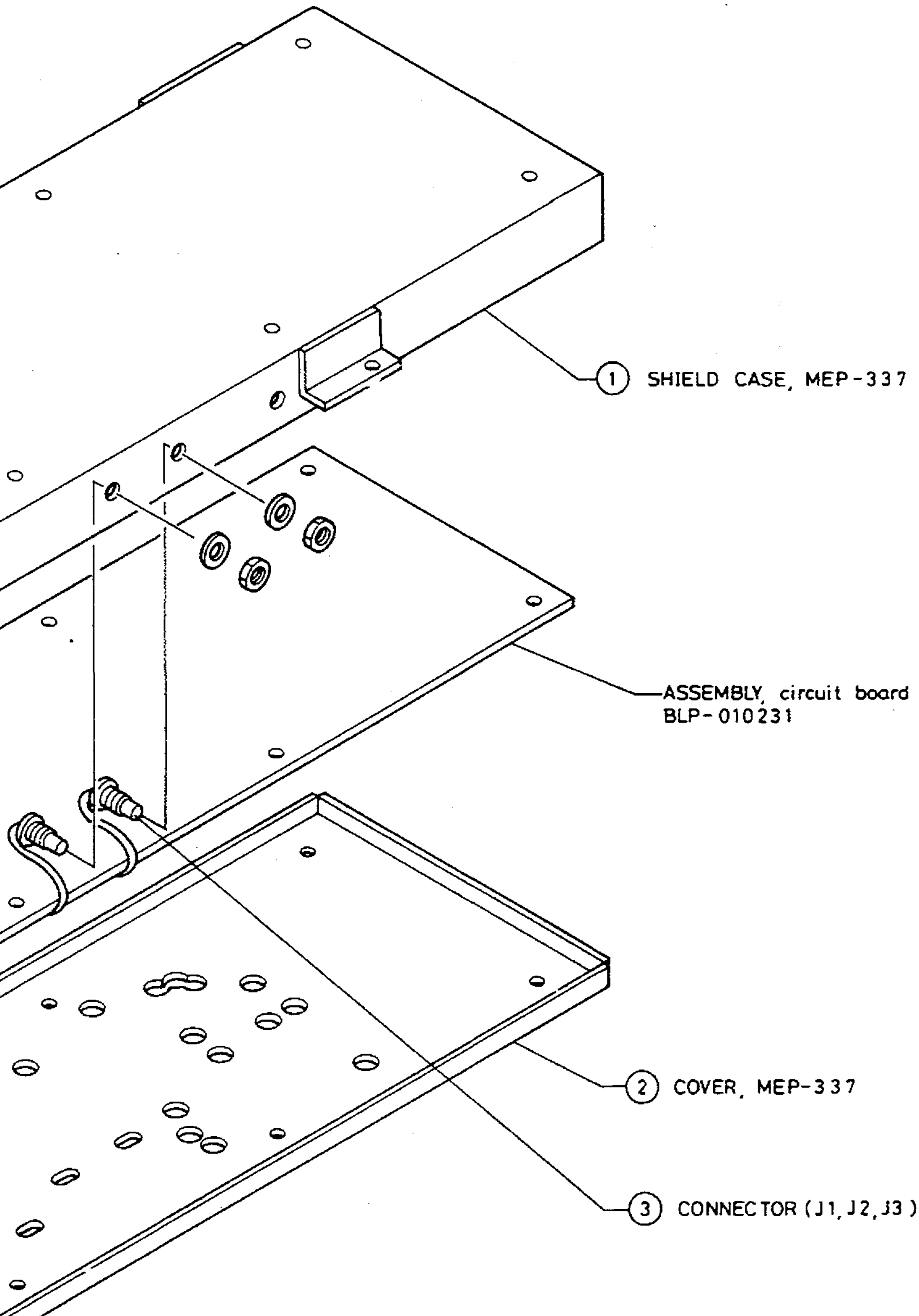
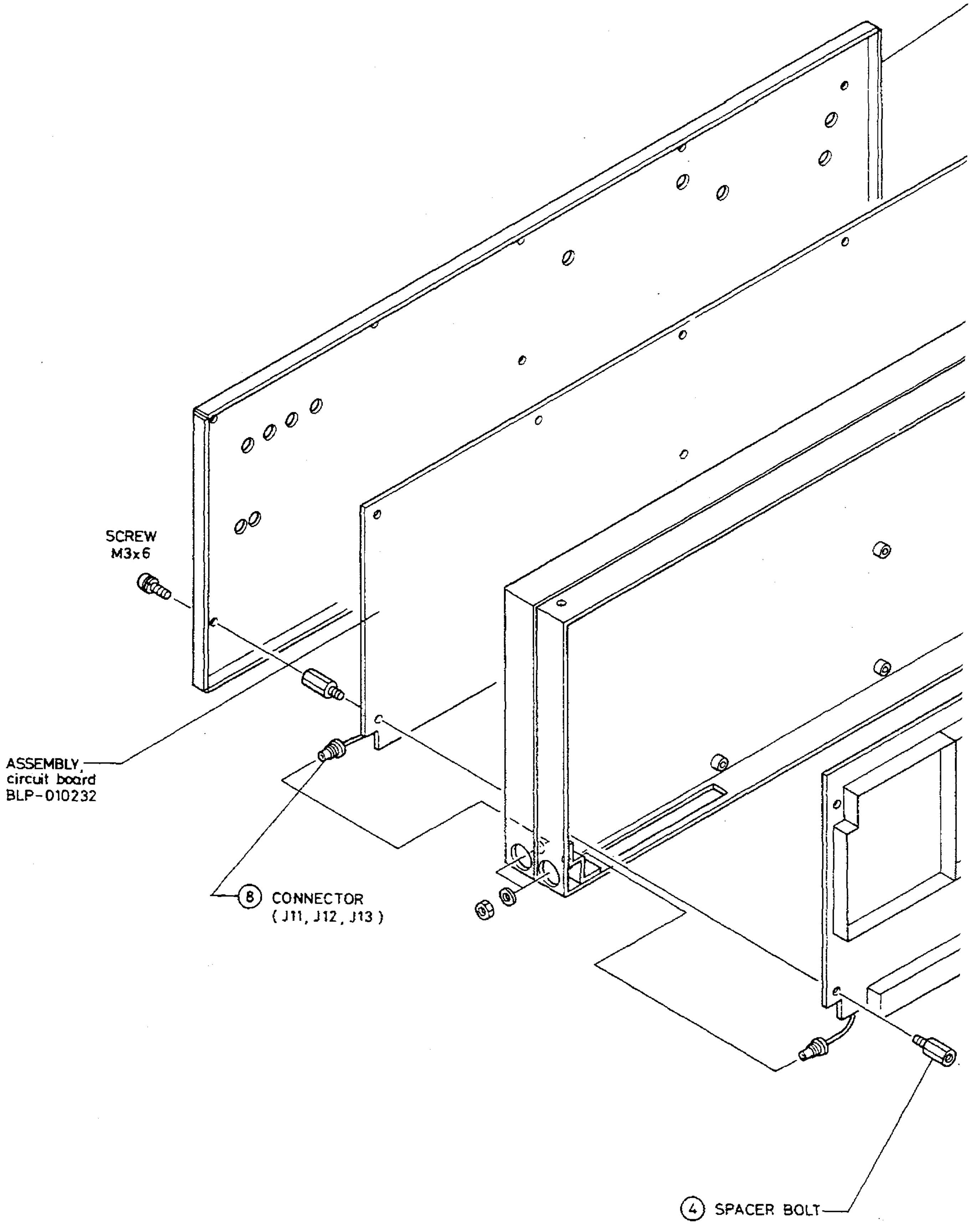


Fig. 14-7
TR4172
MECHANICAL PARTS
LOG BLOCK
MEP-337 ASSEMBLY


SCREW
M3x6
ASSEMBLY,
circuit board
BLP-010232
8 CONNECTOR
(J11, J12, J13)
4 SPACER BOLT

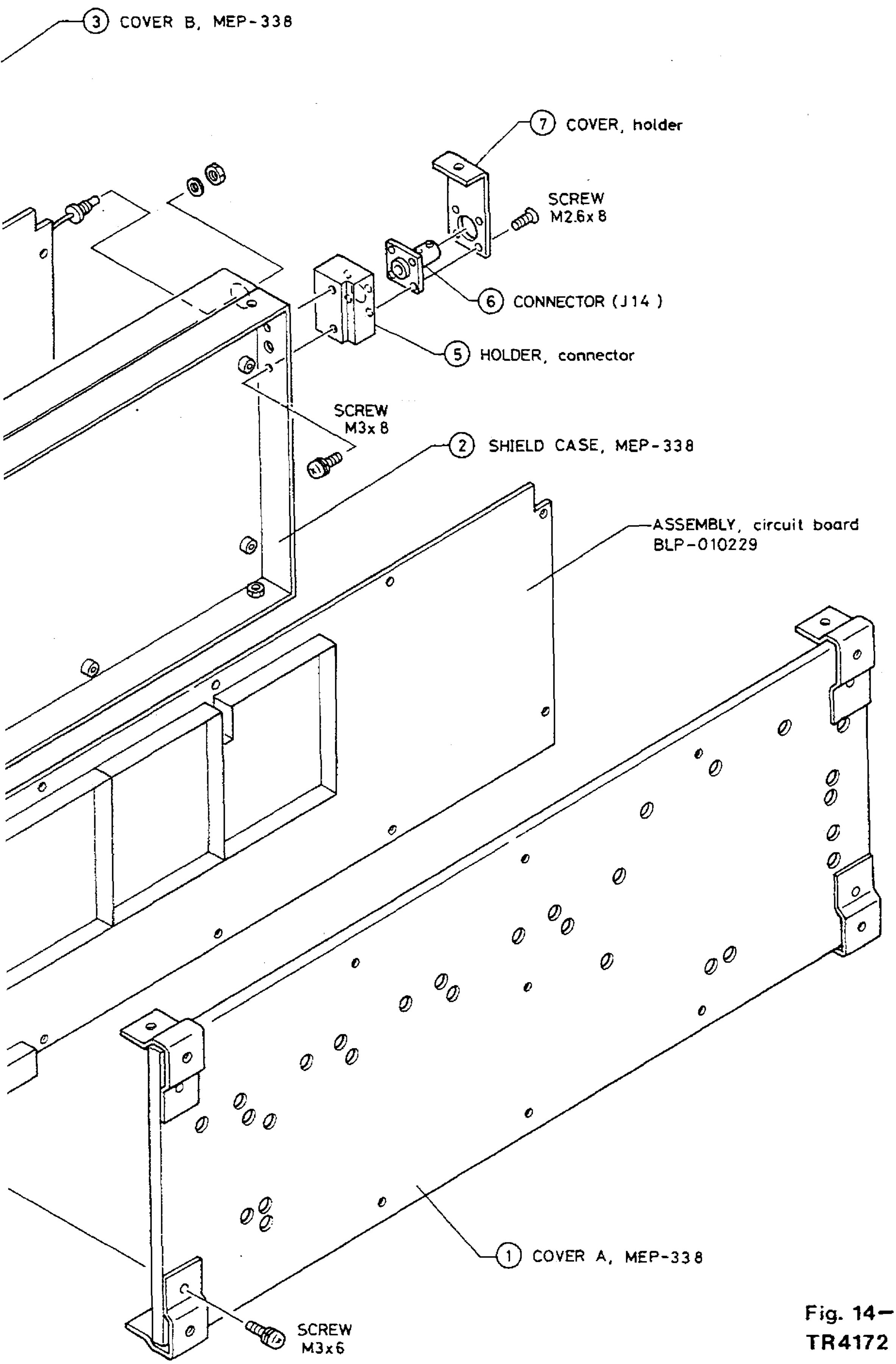
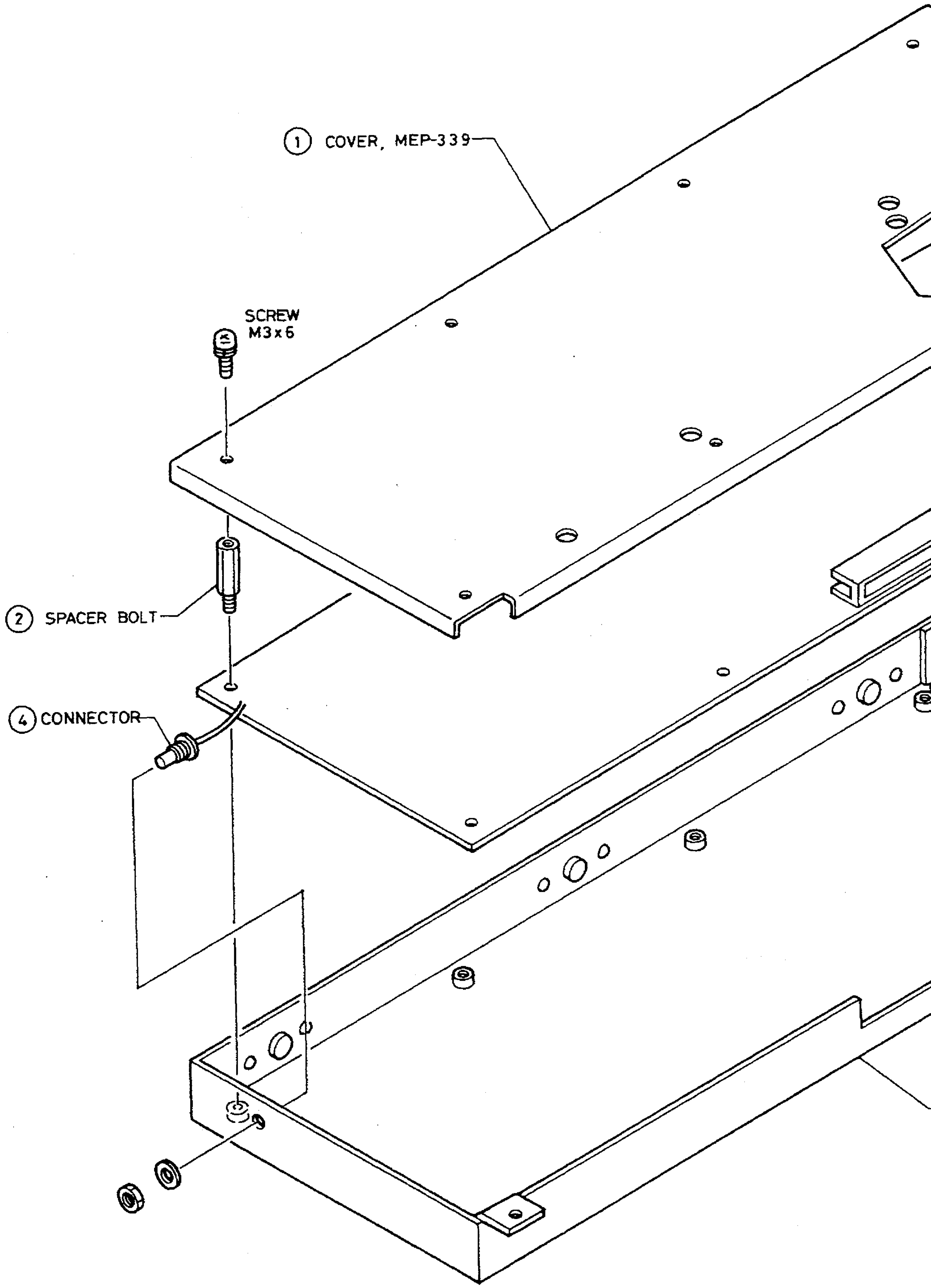


Fig. 14-8
TR4172
MECHANICAL PARTS
IF BLOCK
MEP-338 ASSEMBLY



1 COVER, MEP-339
SCREW
M3x6
2 SPACER BOLT
4 CONNECTOR

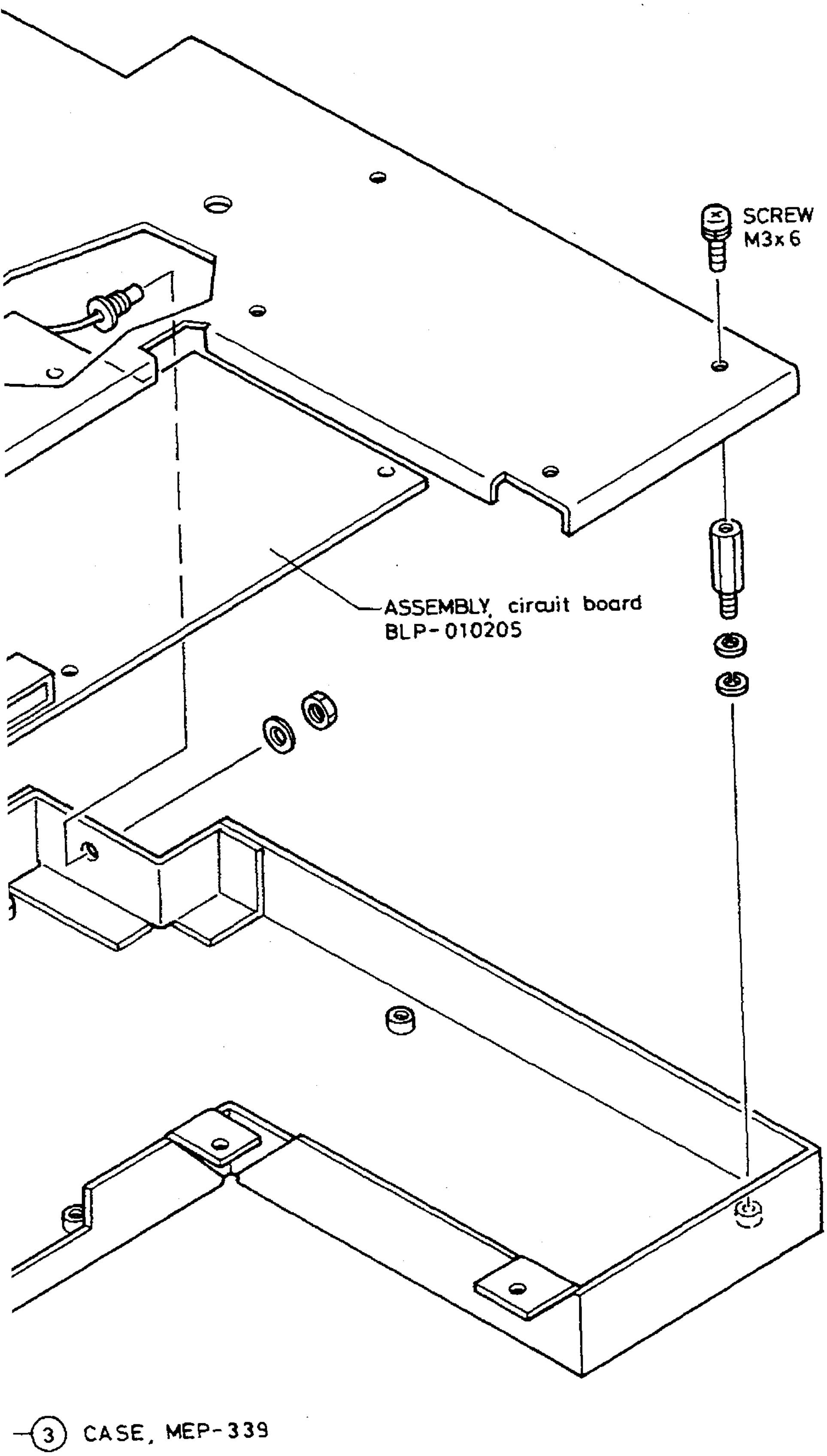


Fig. 14-9
TR4172
MECHANICAL PARTS
PHASE BLOCK
MEP-339 ASSEMBLY

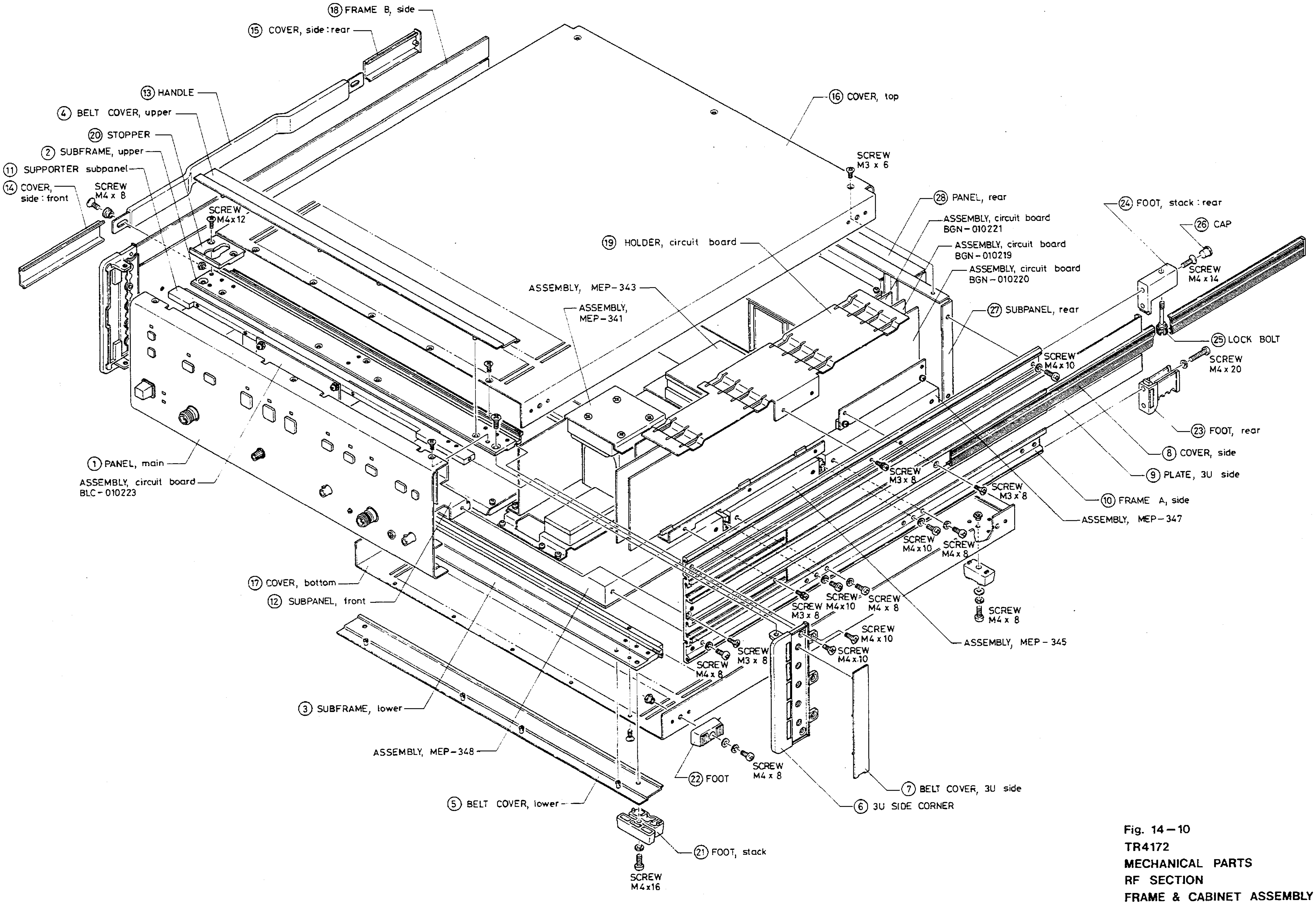


Fig. 14-10
TR4172
MECHANICAL PARTS
RF SECTION
FRAME & CABINET ASSEMBLY

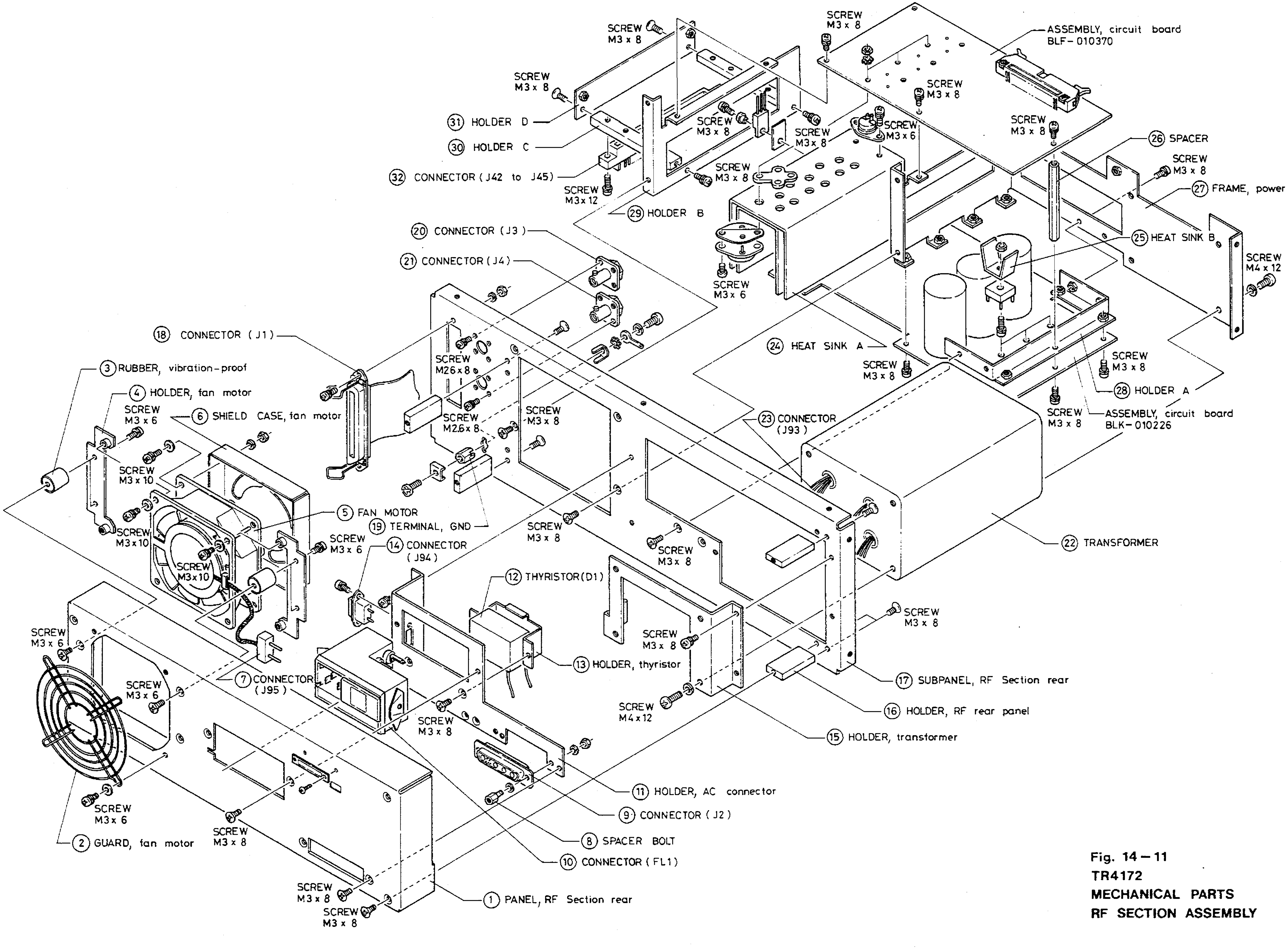


Fig. 14 – 11
TR4172
MECHANICAL PARTS
RF SECTION ASSEMBLY

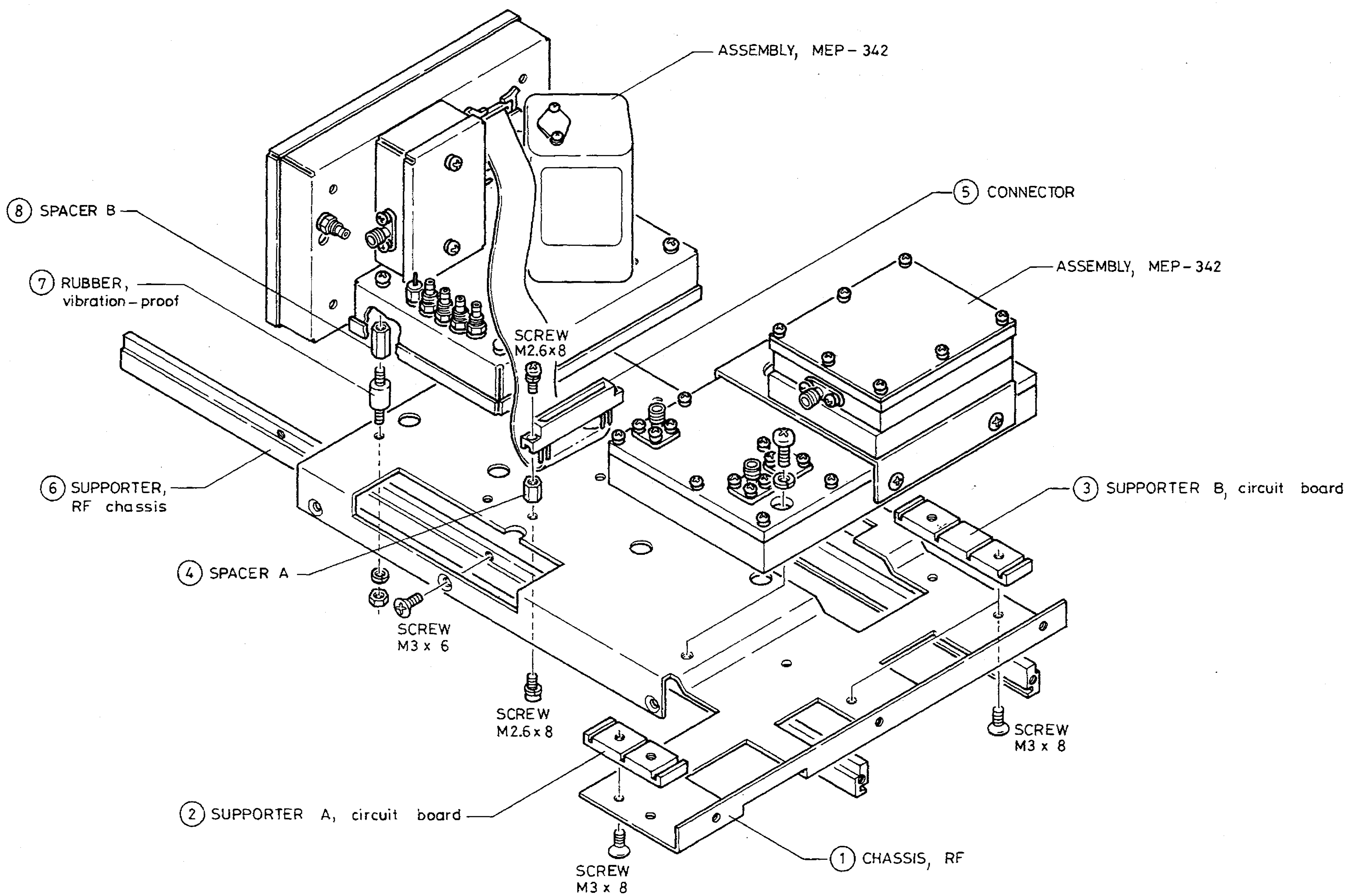


Fig. 14-12
TR4172
MECHANICAL PARTS
RF CHASSIS ASSEMBLY

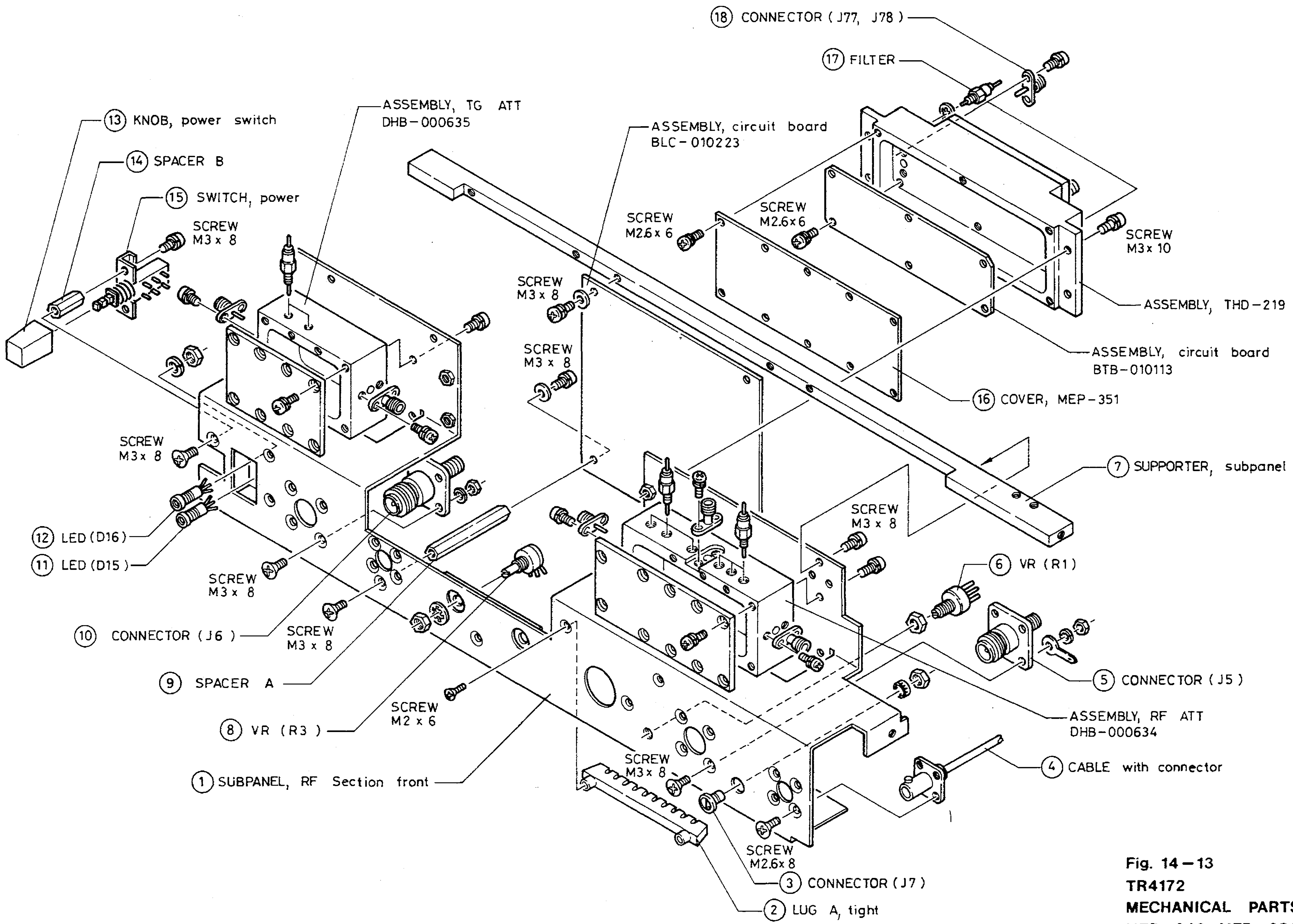


Fig. 14-13
TR4172
MECHANICAL PARTS
MEP-340 MEP-351
ASSEMBLY

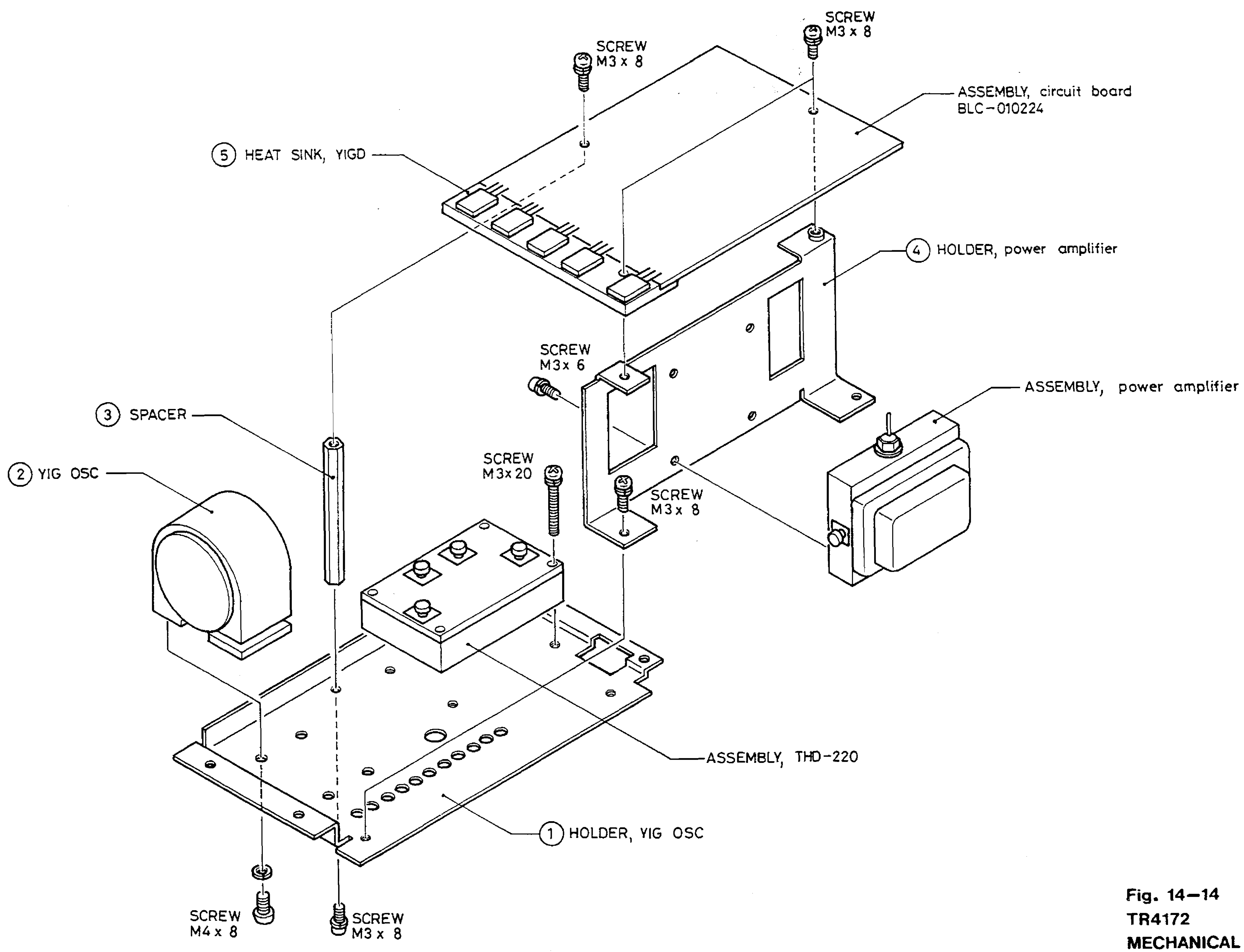


Fig. 14-14
TR4172
MECHANICAL PARTS
YIG OSCILLATOR BLOCK
MEP-341 ASSEMBLY

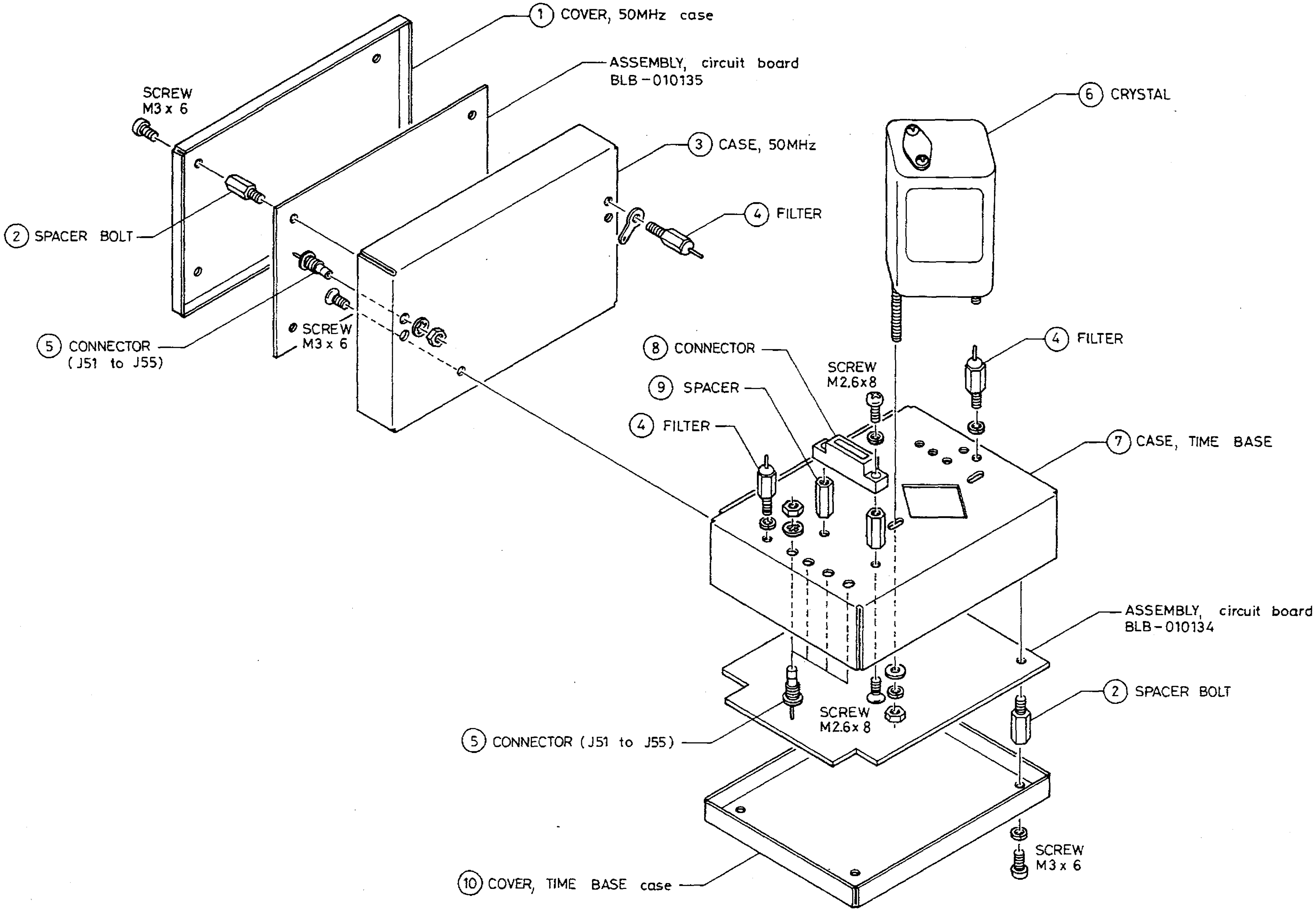
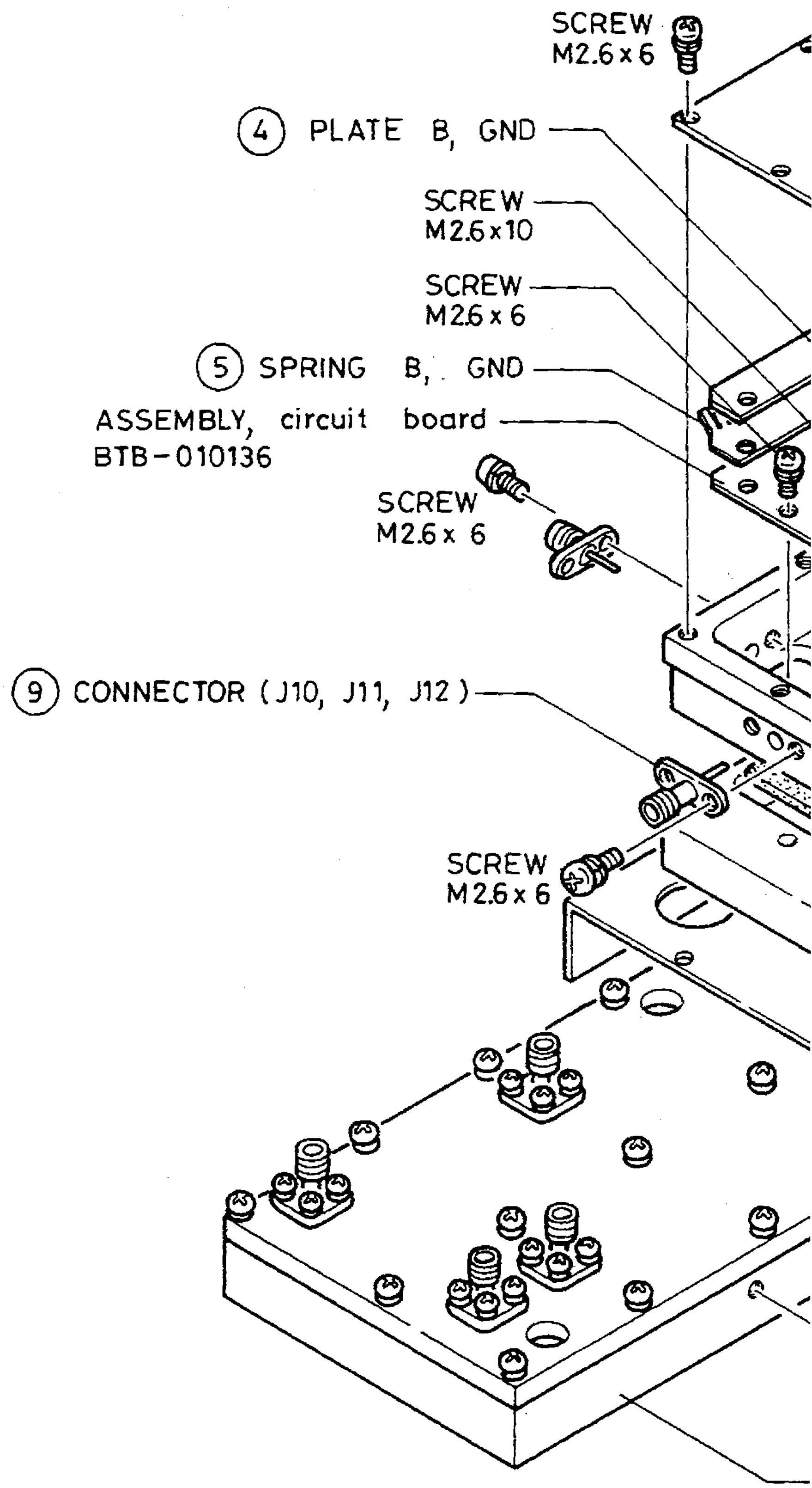


Fig. 14–15
TR4172
MECHANICAL PARTS
STANDARD FREQUENCY BLOCK
MEP–342 ASSEMBLY


SCREW
M2.6 x 6
4 PLATE B, GND
SCREW
M2.6 x 10
SCREW
M2.6 x 6
5 SPRING B, GND
ASSEMBLY, circuit board
BTB-010136
SCREW
M2.6 x 6
9 CONNECTOR (J10, J11, J12)
SCREW
M2.6 x 6

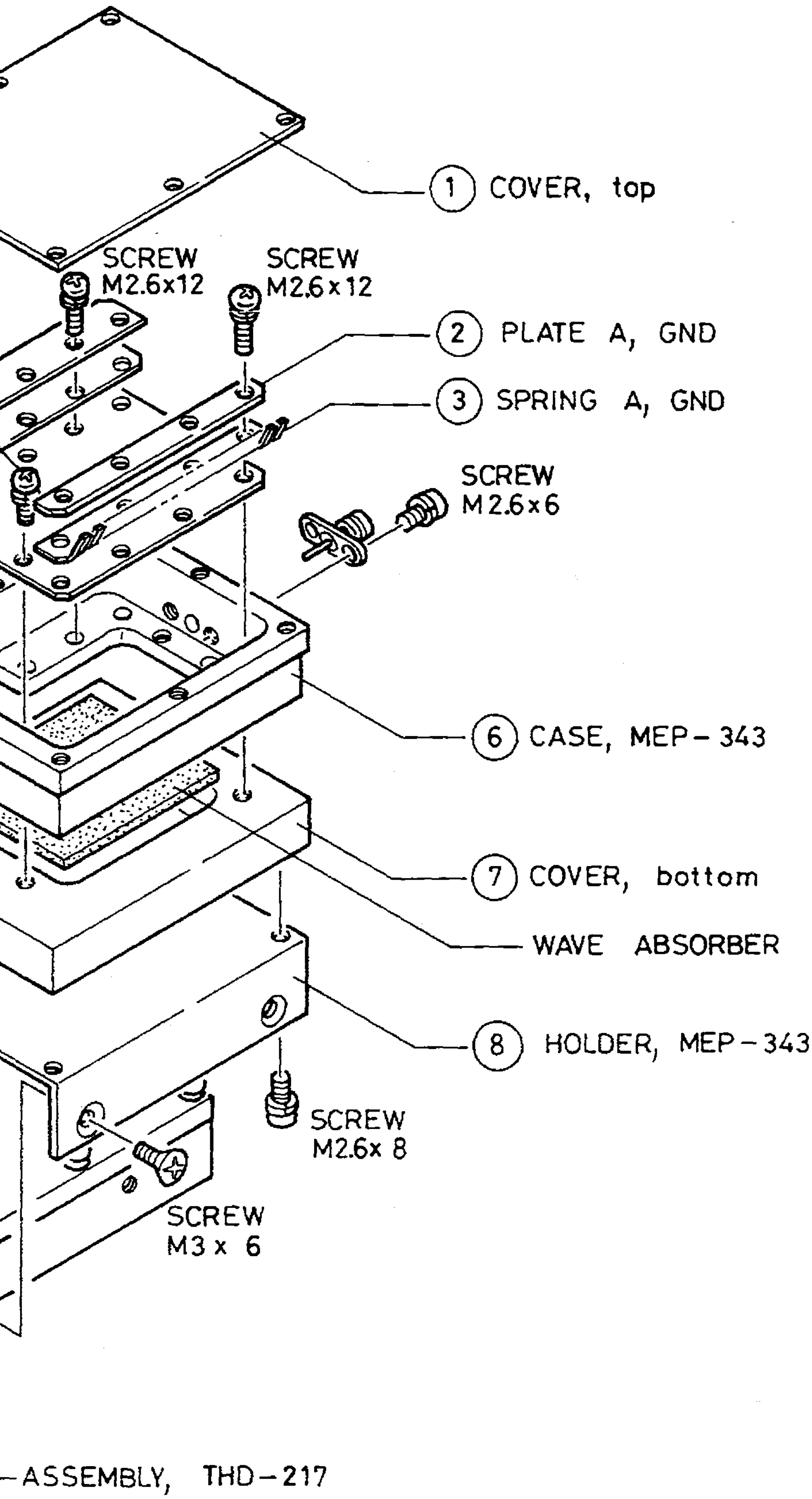


Fig. 14-16
TR4172
MECHANICAL PARTS
1st MIXER BLOCK
MEP-343 ASSEMBLY

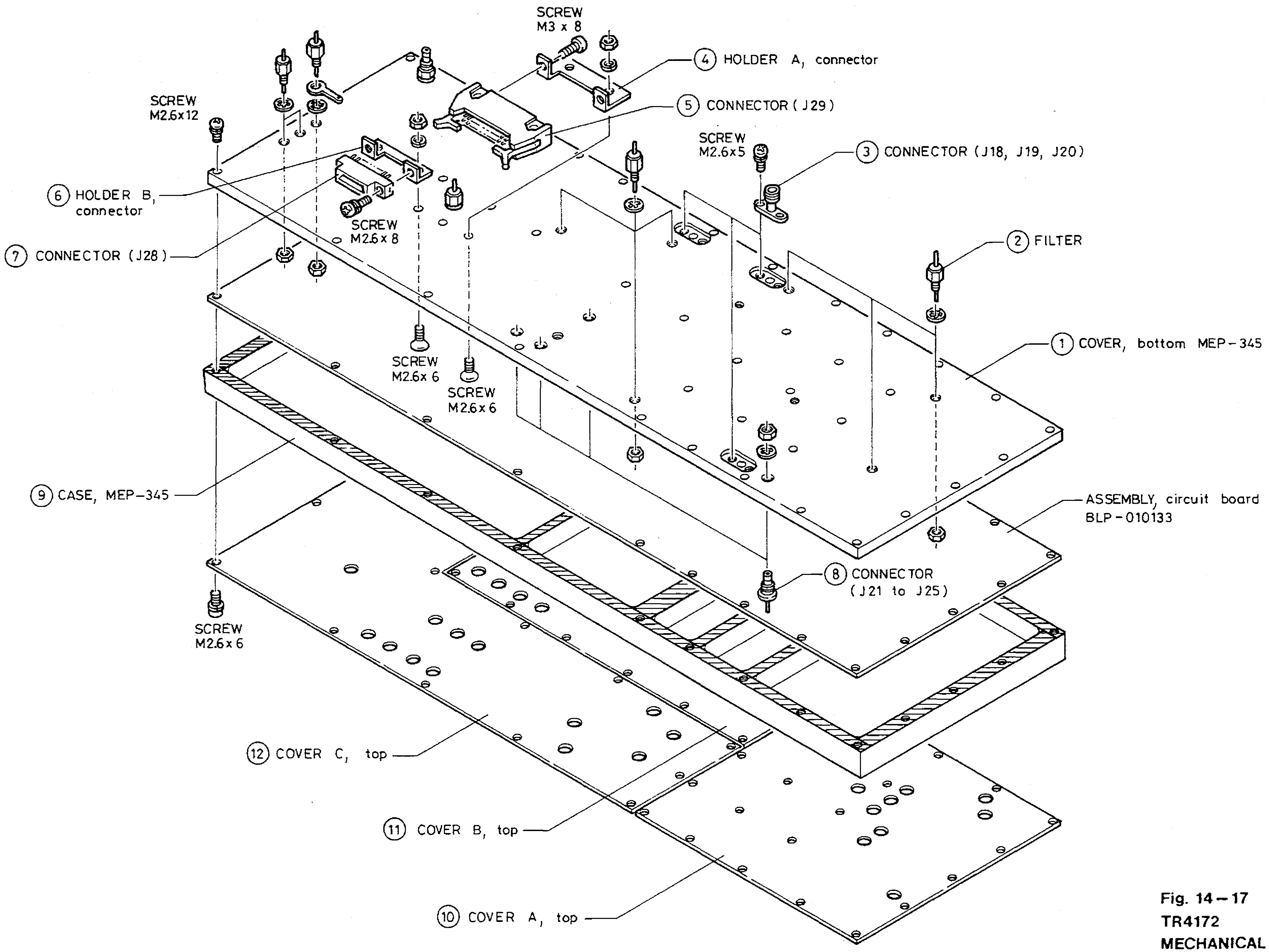


Fig. 14-17
TR4172
MECHANICAL PARTS
RF BLOCK MEP-345
ASSEMBLY

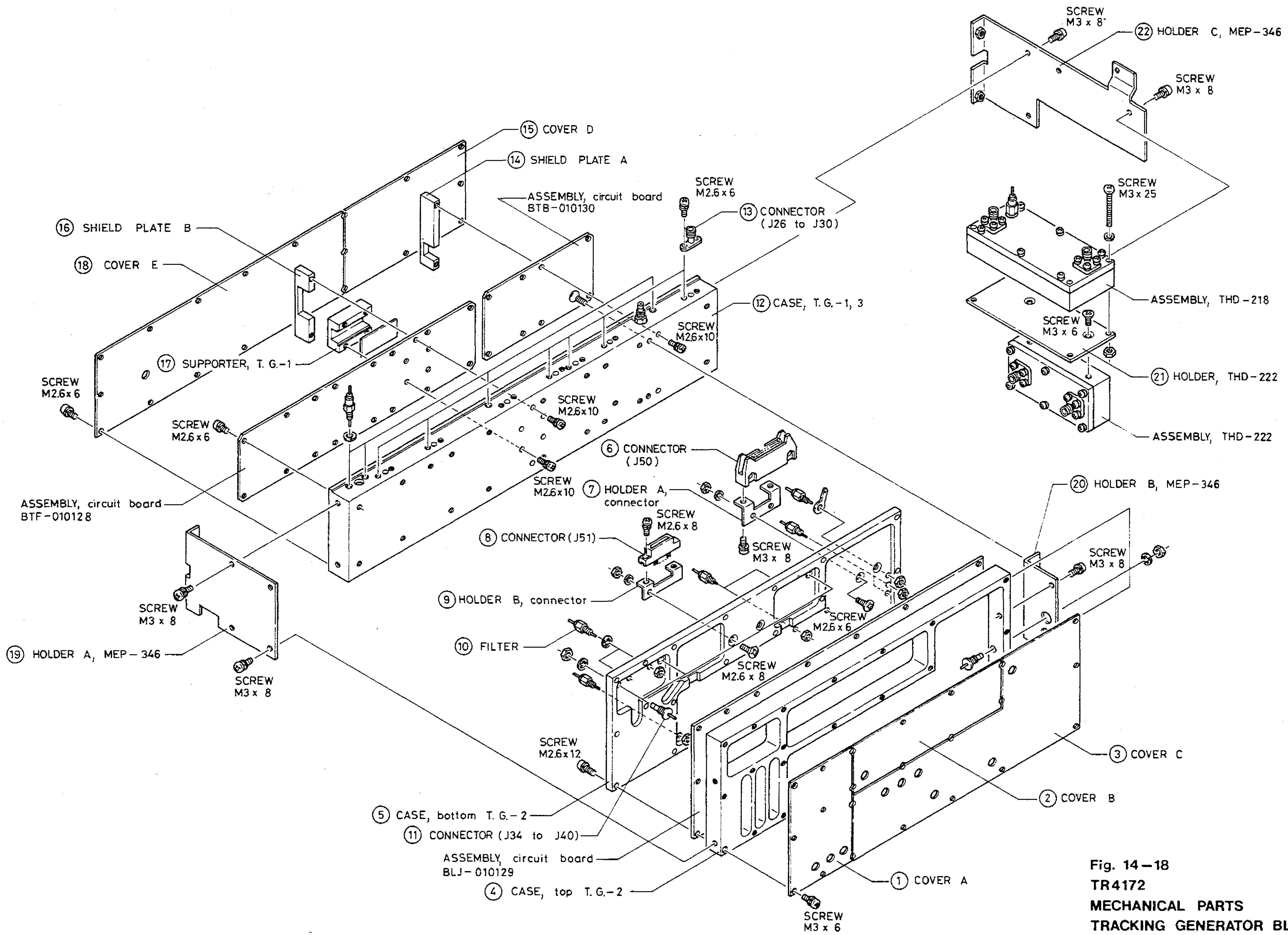


Fig. 14-18
TR4172
MECHANICAL PARTS
TRACKING GENERATOR BLOCK
MEP-346 ASSEMBLY

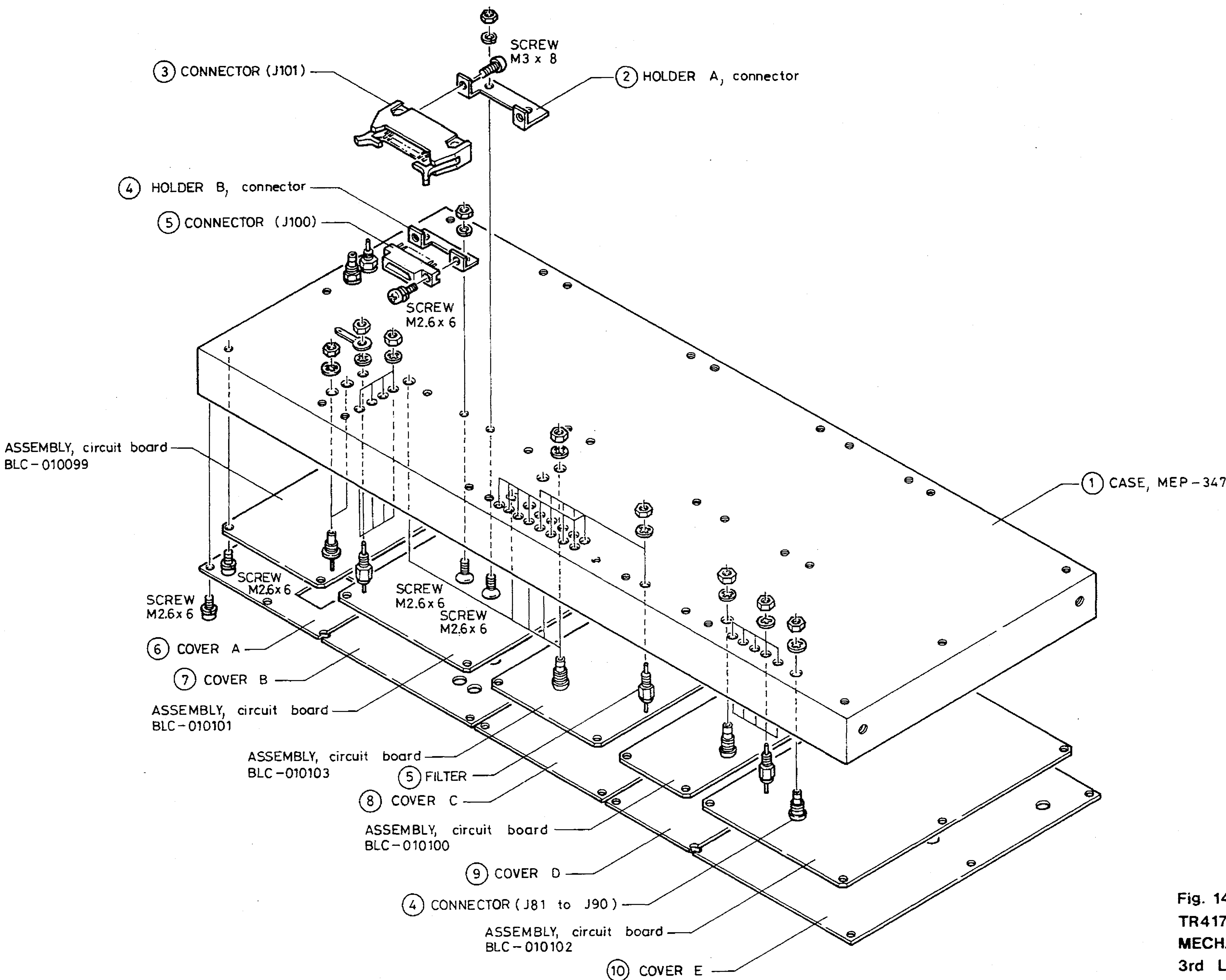


Fig. 14-19
TR4172
MECHANICAL PARTS
3rd LOCAL BLOCK
MEP-347 ASSEMBLY

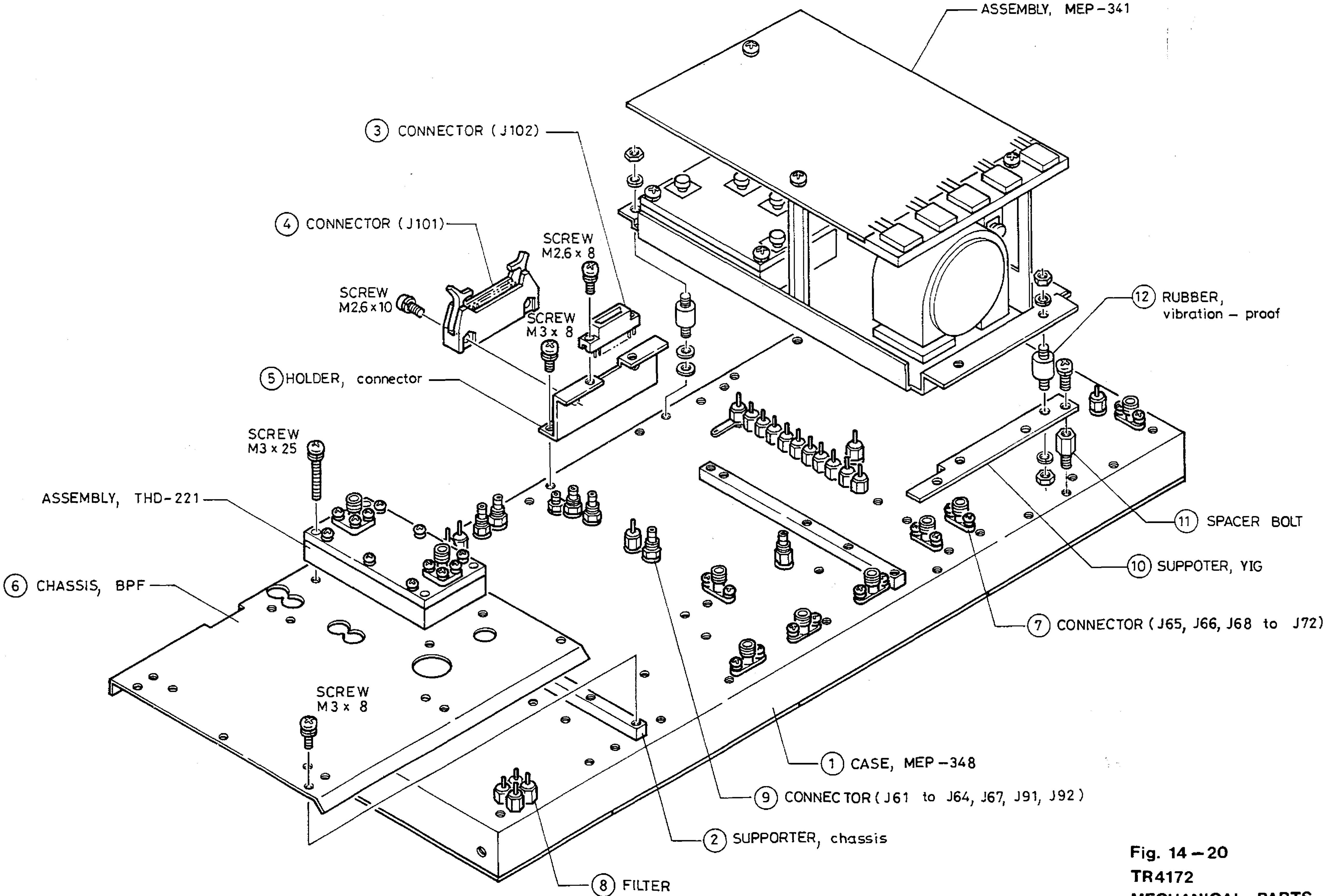


Fig. 14 – 20
TR4172
MECHANICAL PARTS
1st LOCAL PLL BLOCK
MEP – 348 ASSEMBLY (1)

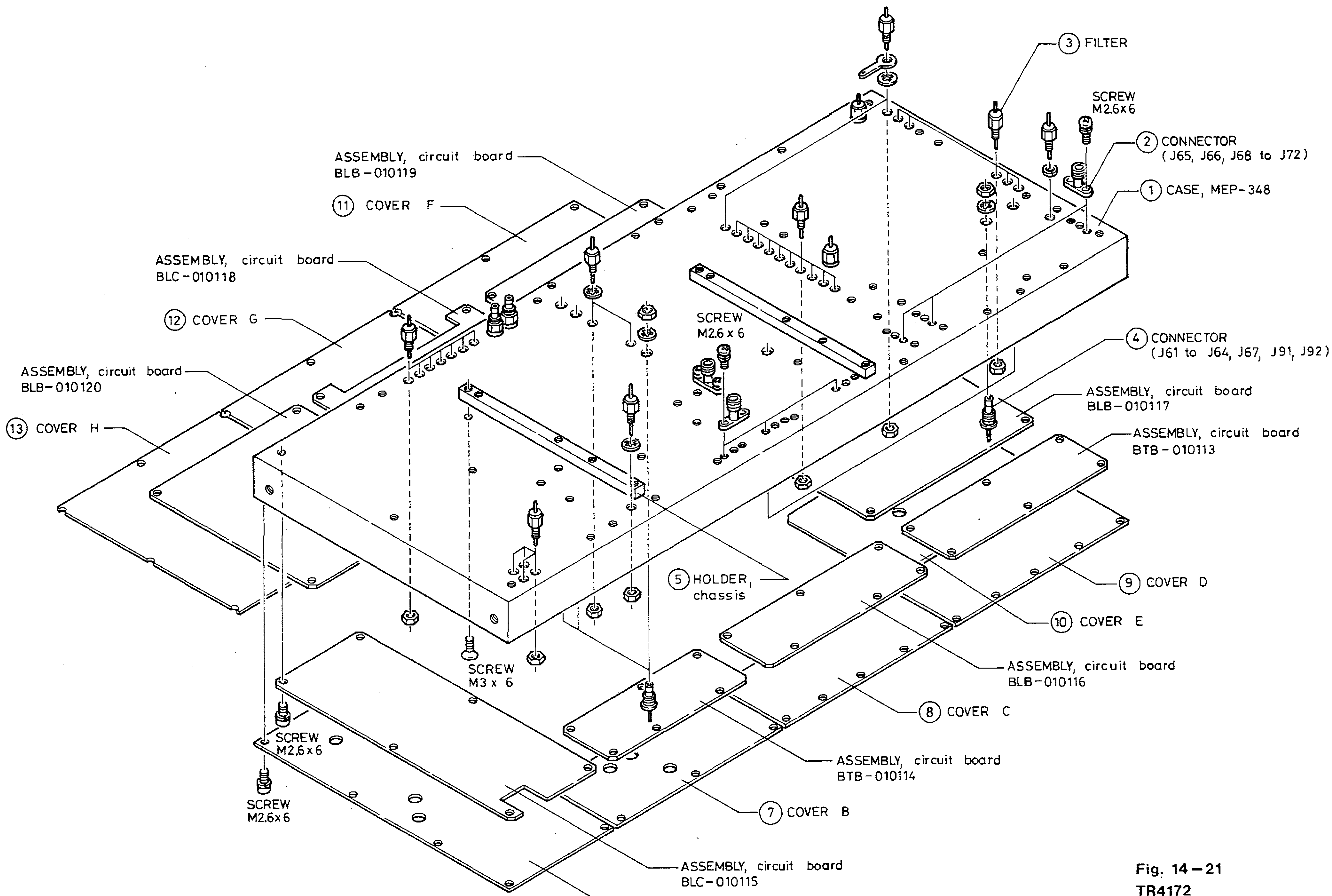
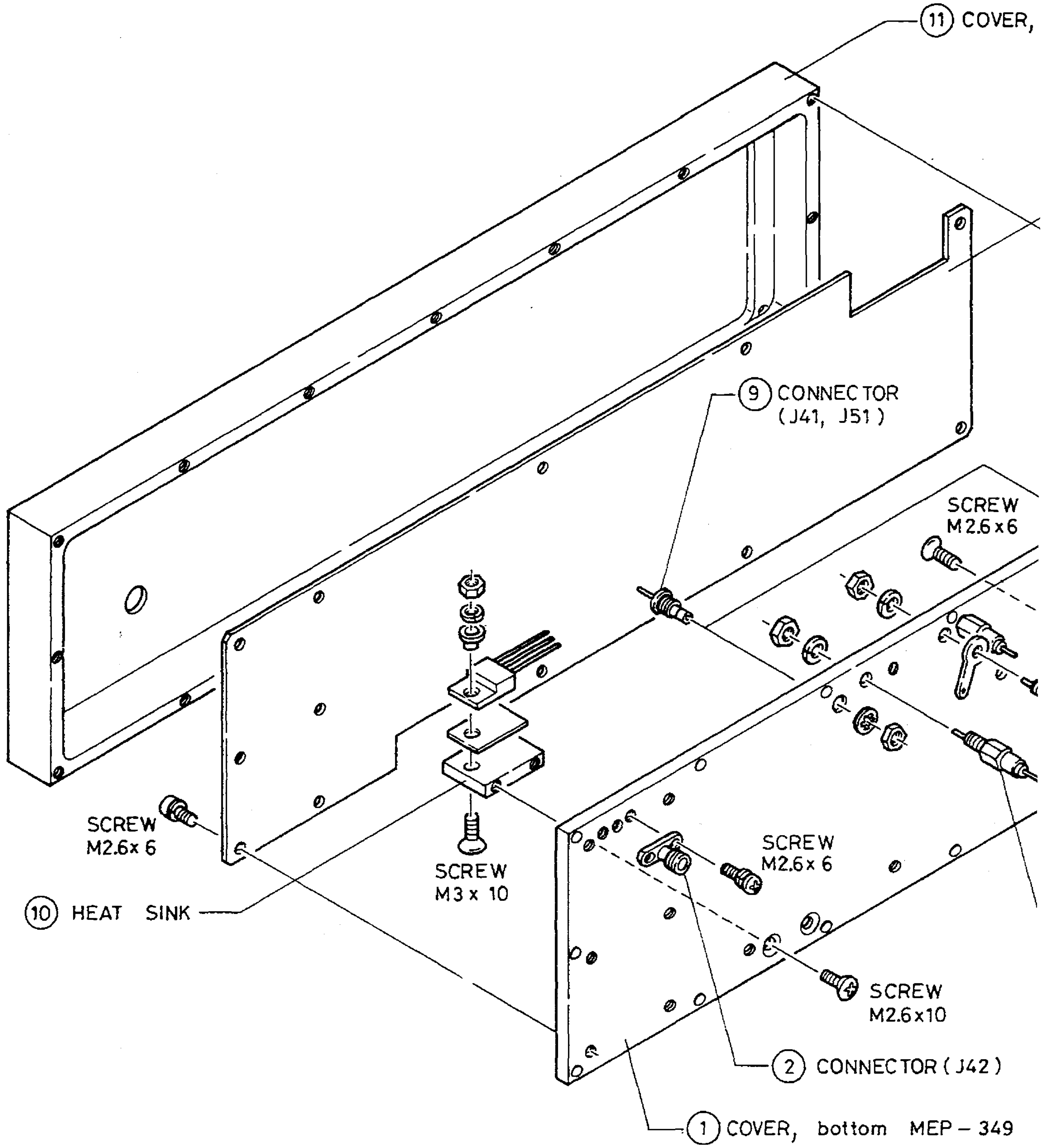


Fig. 14-21
TR4172
MECHANICAL PARTS
1st LOCAL PLL BLOCK
MEP-348 ASSEMBLY (2)



(11) COVER,
(9) CONNECTOR
(J41, J51)
SCREW
M2.6x6
SCREW
M2.6x 6
SCREW
M3 x 10
(10) HEAT SINK
SCREW
M2.6x 6
SCREW
M2.6x10
(2) CONNECTOR (J42)
(1) COVER, bottom MEP – 349

top MEP-349

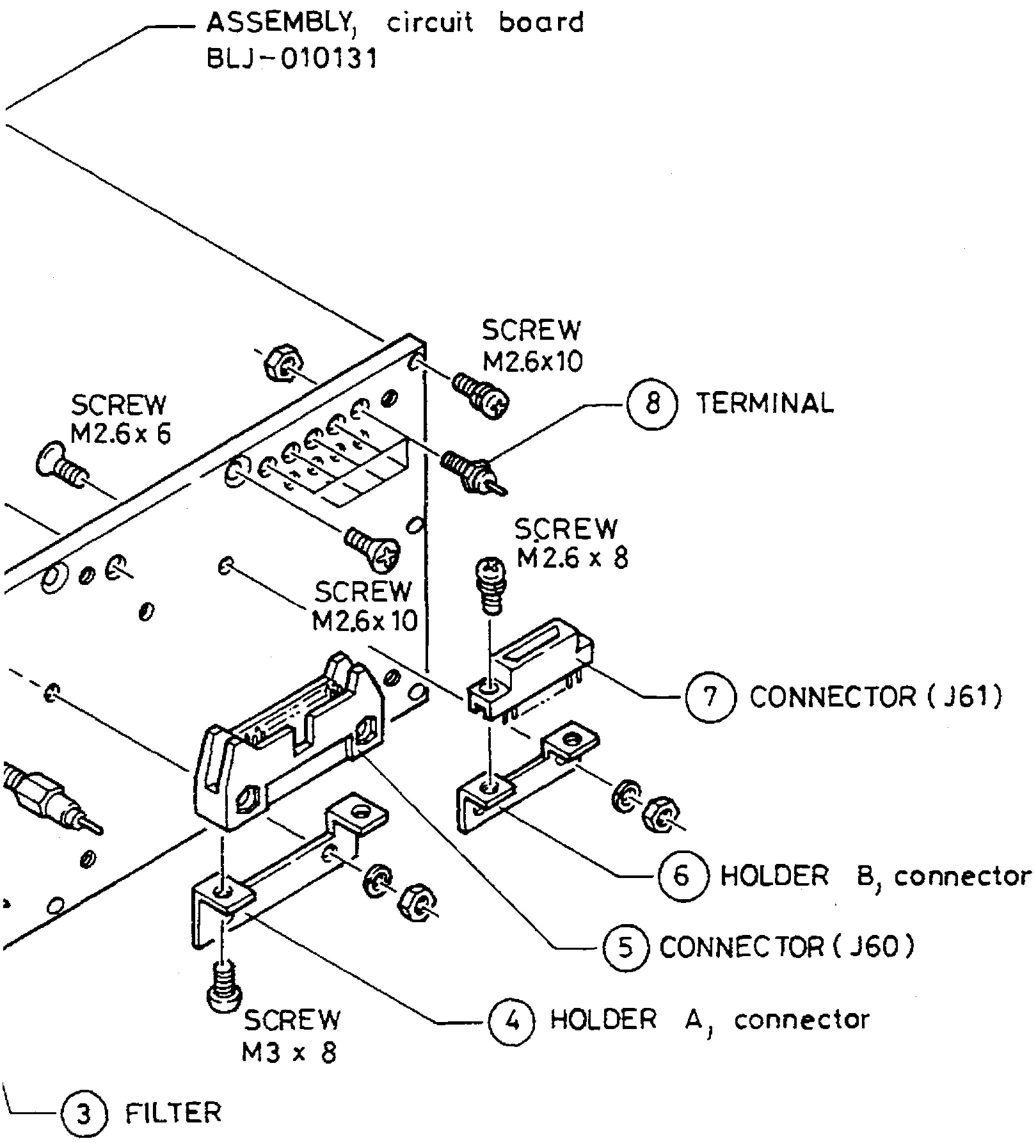
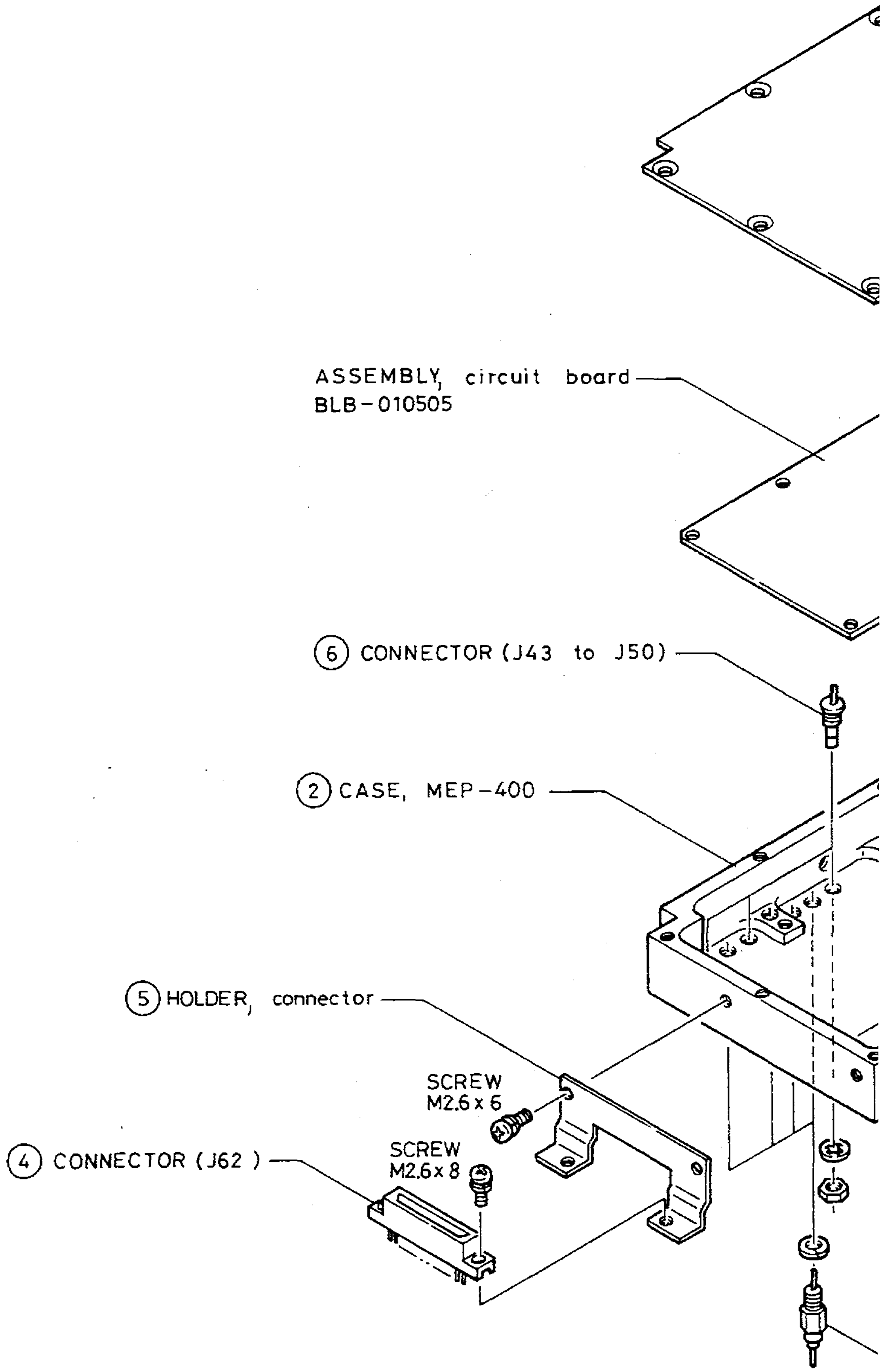


Fig. 14-22
TR4172
MECHANICAL PARTS
COUNTER BLOCK
MEP-349 ASSEMBLY


ASSEMBLY, circuit board
BLB-010505
6 CONNECTOR (J43 to J50)
2 CASE, MEP-400
5 HOLDER, connector
SCREW
M2.6 x 6
SCREW
M2.6 x 8
4 CONNECTOR (J62)

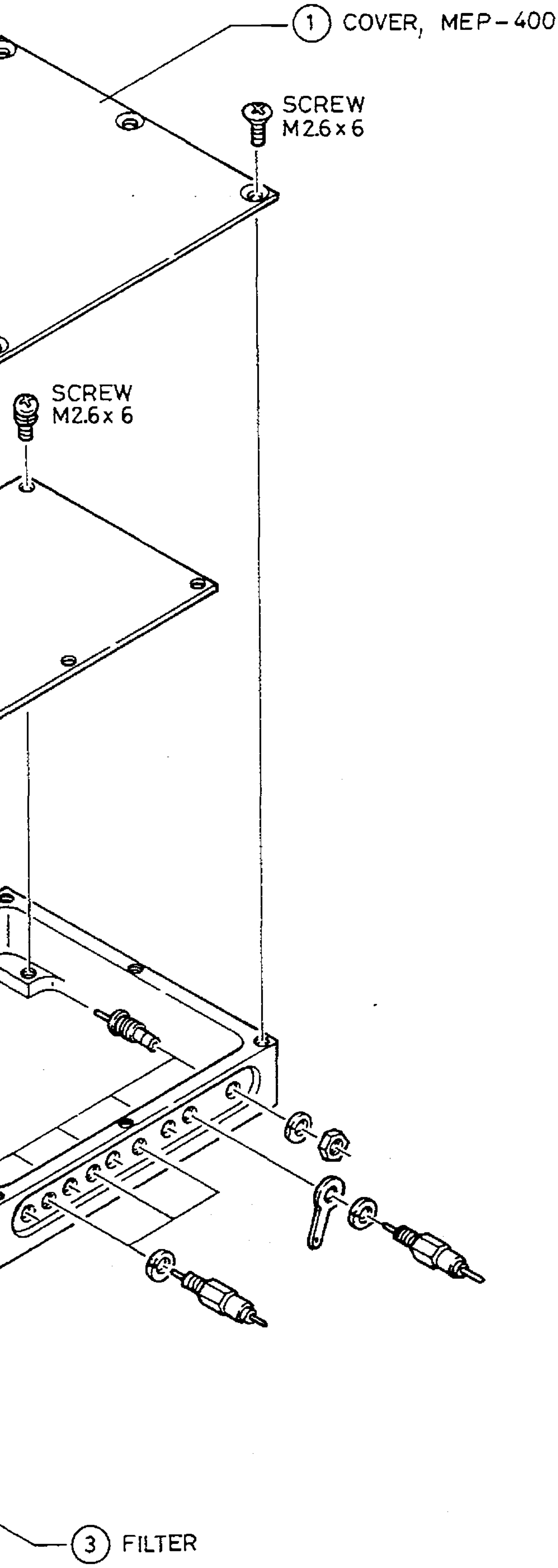
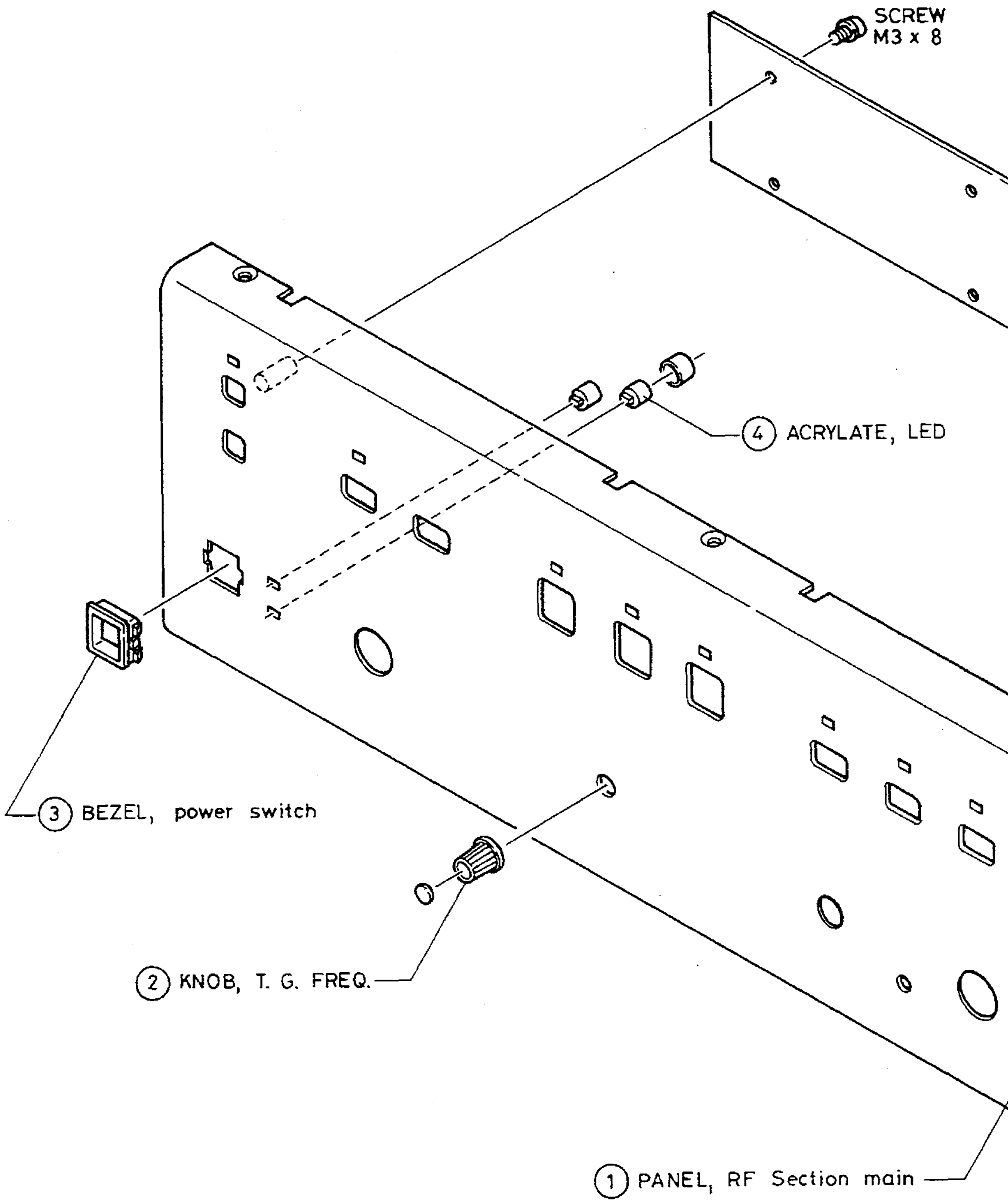


Fig. 14-23
TR4172
MECHANICAL PARTS
COUNTER BLOCK
MEP-400 ASSEMBLY


SCREW
M3 x 8
4 ACRYLATE, LED
3 BEZEL, power switch
2 KNOB, T. G. FREQ.
1 PANEL, RF Section main

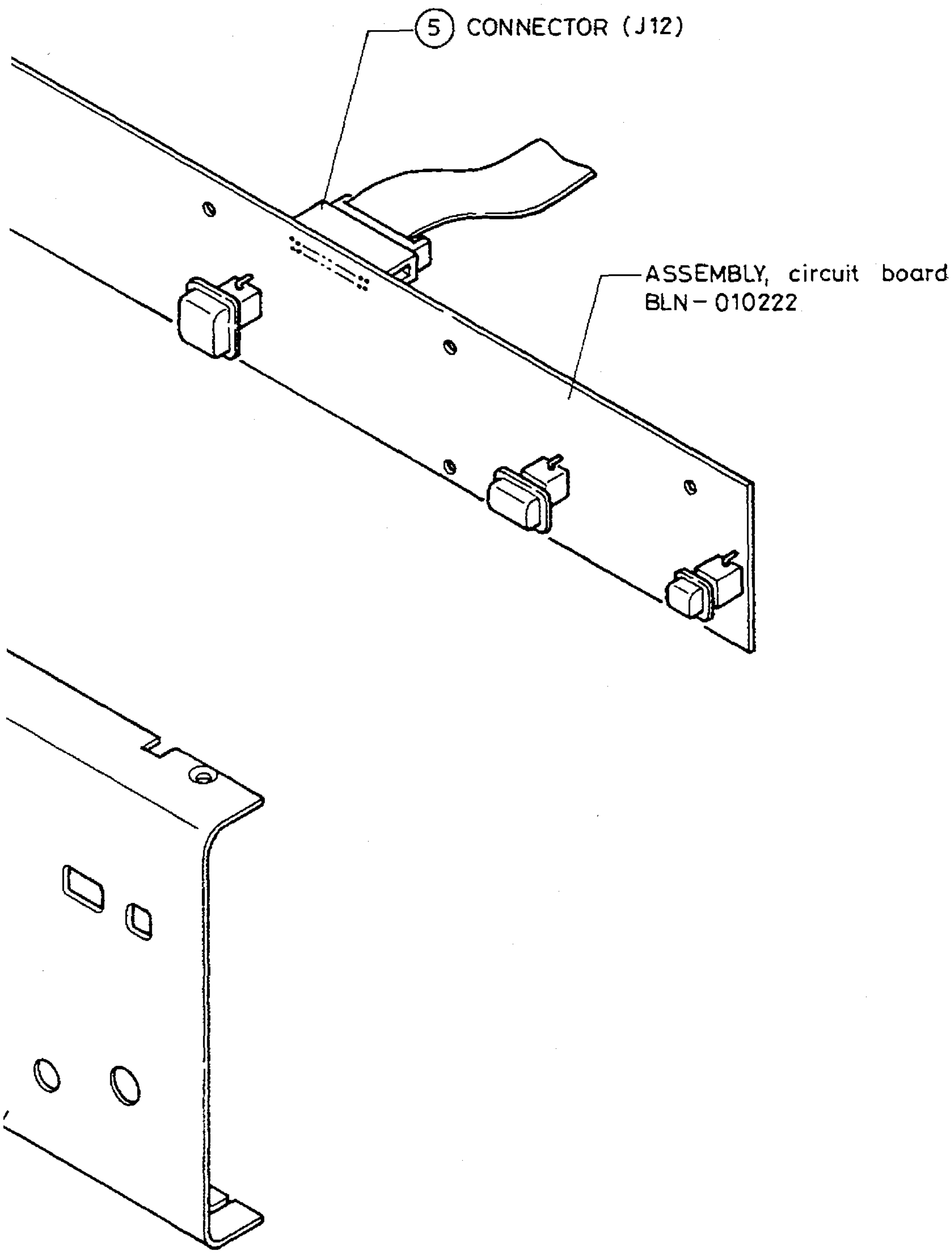
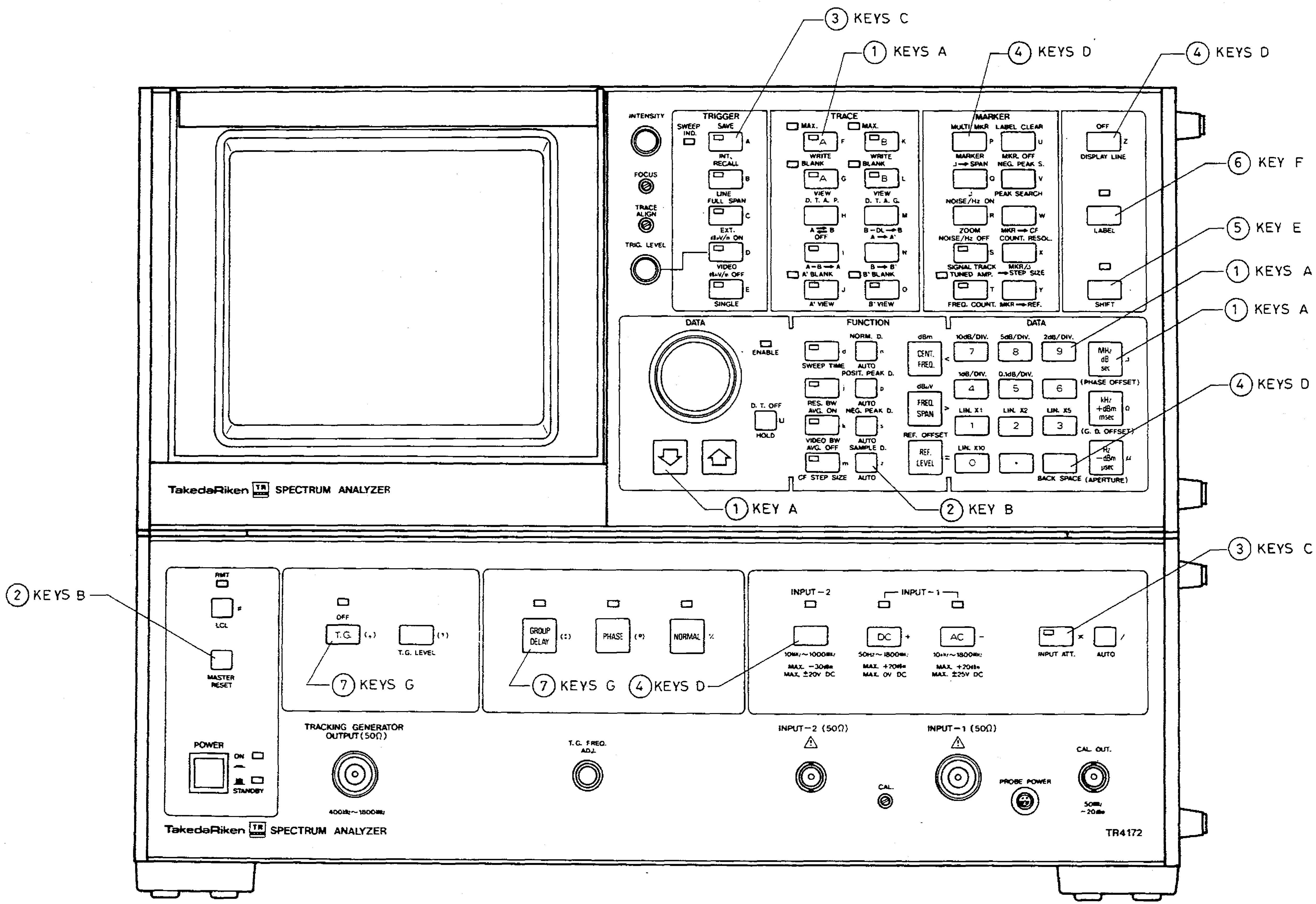


Fig. 14-24
TR4172
MECHANICAL PARTS
RF KEY BLOCK
MEP-352 ASSEMBLY



FRONT VIEW

Fig. 14 – 25
TR4172
LIST OF STOCK NUMBERS
OF MAIN PANEL KEYS

APPENDIX DOUBLE SHIFT FUNCTION LIST

[SHIFT] + [LABEL] +

No.	Page	Contents
L	4-50	A/2 -- B/2
M	4-64'	QP check 10 kHz to 150 kHz
N	4-64'	QP check 150kHz to 30 MHz
O	4-64'	QP check 30 MHz to 1 GHz
P	4-95	N dB DOWN WIDTH
P	4-98	NEXT PEAK
V	4-22	Successive peak search
W	4-62	Error correction routine
X	4-62	Error correction list
Z	4-68	Writing upper and lower limits
d	4-73	Sweep reset
j	4-65	QP measurement 10 kHz to 150 kHz
k	4-65	QP measurement 150 kHz to 30 MHz
m	4-65	QP measurement 30 MHz to 1000 MHz
p	4-73	RES. BW 7 Hz
z	4-64	QP measurement OFF
[CENT. FREQ.] <	4-61	Logarithmic display of frequency axis (LOG. DISPLAY)
0	9-1	Impedance measurement (Optional)
1	4-75	Occupied bandwidth display and/or leakage power arithmetic operation (Optional)
2	4-65	X-Y recorder output or X-Y plotter interface (Optional)
4	4-74	Center frequency repositioning (Drift cancel)
5	4-74	Center frequency repositioning reset
7	4-89	Internal standard output ON
8	4-89	Internal standard output OFF
[BACK SPACE]	4-63	Error correction data clear
[MHz dB sec] ⌟	4-59'	SAVE register alternate sweep-1
[kHz +dBm msec] Ω	4-61	SAVE register alternate sweep-2
Q	8-25	Output to TR9834R Plotter

Functions for maintenace:

D		Fine tune flatness check
S		IF step amp. check (10 dB step),

If "S" is pressed again, IF step amp. check (1 dB step)
If "S" is pressed again, IF step amp. check (0.1 dB step)

APPENDIX TRIPLE SHIFT FUNCTION LIST

	Contents	Display
A	Tune main data 0 to 2000 (YIG I/O)	STEP MAIN ....
B	Tune FM data 0 to 100 (YIG I/O)	STEP FM ....
C	3rd tune A 0 to 2000 (3rd LO I/O)	STEP 3rd A ....
D	3rd tune B 0 to 100 (3rd LO I/O)	STEP 3rd B ....
E	3rd tune C 0 to 100 (3rd LO I/O)	STEP 3rd C ....
F	YIG lock ON	YIG LOCK ... MHz
G	YIG lock 1, 2 OFF	YIG LOCK 1, 2 OFF
H	YIG lock 2 OFF	YIG LOCK 2 OFF
I	3rd local lock N	STEP 3rd N
J	3rd local lock OFF	3rd LOCK OFF
K	YIG lock "N" changing	STEP YIG N ....
.	LO frequency checks (Press 0 to 9)	COUNT POINT ....

INDEX

APPENDIX

TECHNICAL TERMS

Bandwidth Accuracy

It is the accuracy of bandwidth for IF Filter and is expressed with the deviation to the nominal value at the point 3 dB below the peak. This ability is not necessarily considered in level measurments for normal continued signals but in level measurements for noise signals.

Bandwidth Selectivity

The characteristic of Band Pass Filter is not of a normal rectangle but is given with an attenuation characteristic similar to that in a gauss distribution. Consequently, in the case there are two signals mixed in neighbor, the smaller signal is hidden in the skirt of the larger one as shown in Fig. A-1 below. It is therefore necessary to specify the bandwidth at an appropriate area (60 dB), and the ratio of the bandwidth at 3 dB and 60 dB points in expressed as Bandwidth Selectivity.

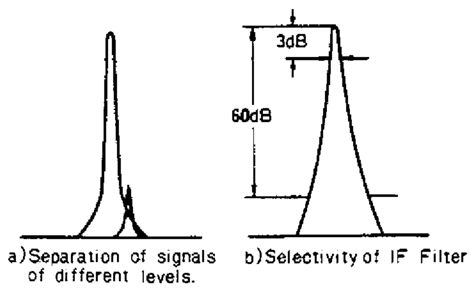


Fig. A-1 B.W. selectivity reference diagram

Bandwidth Switching Accuracy

Appropriate number if IF Filter is prepared and used by switching in analyzing a signal into spectrum so as to obtain best resolution for the scan width. The IF Filter retains inherent loss individually, and switching to the other causes an error corresponding to respective loss even in the case of measuring the same signal. This is defined as Bandwidth Switching Accuracy.

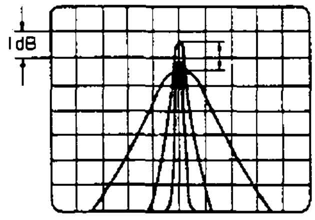


Fig. A-2 B.W. switching accuracy reference diagram

Frequency Response
This term is generally used to express an amplitude (frequency) characteristic of a frequency. With a Spectrum Analyzer, it means the frequency characteristic (flatness) of input attenuator and mixer, etc. for respective input frequency and is indicated in $\pm\Delta$ dB.

Gain compression
If an input signal is applied in excess of a level, CRT display does not indicate correct level but shows as if increase of the input signal level were compressed. This phenomenon is called Gain Compression and defines linearity of the input signal range of the Spectrum Analyzer. Practically used is the range up to the compression of 1 dB.

IF bandwidth
A spectrum Analyzer uses Band Pass Filter (B.P.F.) in analyzing individual frequency components which are composed in an input signal. 3 dB bandwidth of a B.P.F. is called an IF Bandwidth. (Fig. A-3-a) The characteristic of a B.P.F. must be considered in appropriate from depending on the frequency span and sweep time.
TR4172 is designed so that settings are automatically selected to the best. Spectrum resolution is improved as the bandwidth is set narrower in general so that sometimes the resolution of a Spectrum Analyzer is expressed with the narrowest IF Bandwidth. (Fig. A-3-b)

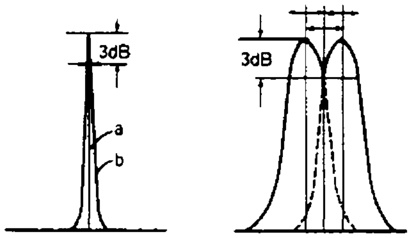


Fig-a IF Bandwidth Fig-b Resolution

Fig. A-3 IF B.W. reference diagram

Input Sensitivity

Input Sensitivity is an ability of a Spectrum Analyzer to detect the smallest signal. It is directly related with the noise generated in the Spectrum Analyzer itself and depends on the IF Bandwidth being used. Input Sensitivity normally means the Average Noise Level at the least IF Bandwidth of the Spectrum Analyzer.

Maximum input level

It is the maximum permissible level at RF input of the Spectrum Analyzer. Permissible level can be changed in accordance with provision of input attenuator.

Noise sideband

Noise Sideband is an ability commonly used in expressing oscillation purity of an oscillator. With a Spectrum Analyzer, the noise generated in local oscillator and phase lock loops in particular appears in the neighbor of the spectrum under measurement and disturbs performance of the Spectrum Analyzer. It is therefore necessary for such an instrument to specify the noise sideband of its own to mention the range where noise sideband of external signals can be analyzed. Typical specifications adapted to a Spectrum Analyzer are shown below.
The one specifies the Noise Sideband being -70 dB below the signal peak, 20 kHz away from the carrier, with 1 kHz IF Bandwidth. Generally used is an expression of the energy existing in a 1 Hz bandwidth.
(Fig. A-4-b)

If the former is expressed in this way of the latter, the signal in 1 Hz bandwidth is about 10 log 1 Hz/1 kHz that is about -30 dB more lower, bearing in mind -70 dB at 1 kHz bandwidth. So, the former can be replaced to read -100 dB/Hz, 20 kHz away from the carrier with 1 kHz Bandwidth.

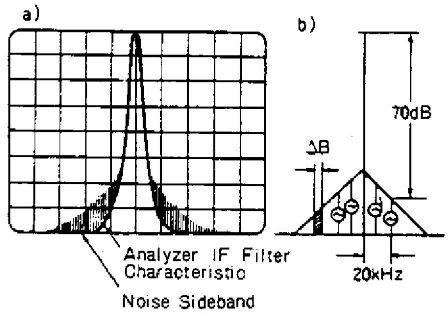


Fig. A-4 Noise sideband reference diagram

Quasi Peak Value Measurement

Reception interference noise in radio communications normally appears in a form of impulse. Such an interference energy is objectively evaluated with a value proportional to the quasi peak value. Since it is necessary to conclude the measurement range and detection time constant, etc. in measurement evaluation, quasi peak value is decided to indicate the measurement value. In accordance with the conclusion, there are JRTC Specifications in Japan and C.I.S.P.R. Specifications in U.S.A.

Reference Level Display Accuracy

Absolute level of the input signal is read with a Specturm Analyzer display in reference to the horizontal top line of the graticule. The level set to the horizontal top line is called the reference level. The reference level can be selected in accordance with the settings of IF GAIN and Input Attenuator in the display of dBm or dBμ. The absolute accuracy of the display is the reference level accuracy.

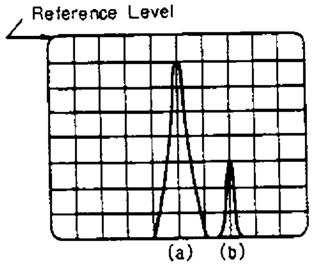


Fig. A-5 REFERENCE LEVEL reference diagram

Residual FM

Residual FM is used to mean short time stability of the local oscillator group built in Spectrum Analyzer, and the drifting frequency bandwidth for a unit time is mentioned in peak to peak. It also indicated the measurement limit in measuring residual FM for the object under measurement.

Residual Response

It is to define the degree of level to which the spurious signal generated in the Spectrum Analyzer is restrained. It is due to a leakage signal like local oscillator output of the Spectrum Analyzer, and care is required in the case of analyzing extermely small input signal.

Spurious

Spurious is undesired signal other than objective signal and is classified in accordance with characteristic of the signal as follows:
Harmonic Spurious: Specifies level of the harmonic which is generated in the Spectrum Analyzer (normally at mixer circuit) when ideal nondistorted signal is applied to the Analyzer. It also expresses the ability of harmonic distortion measurement.
Near-by Spurious: is the small spurious which appears in the neighbor of the Spectrum on the display when a pure single spectral signal is applied to a Spectrum Analyzer.
Nonharmonic Spurious: is called a residual spurious that is spurious of the frequency inherently generated in the Spectrum Analyzer.

Spurious Response

It is the harmonic distortion generated in the input mixer circut as the input level goes up, as shown in the figure below. The level range available in nondistortion depends on fundamental input level and an example shown in the figur is -70 dB for the input level of -30 dB. In practice, the input attenuator is effectively used to decrease the signal level to get it appropriate.

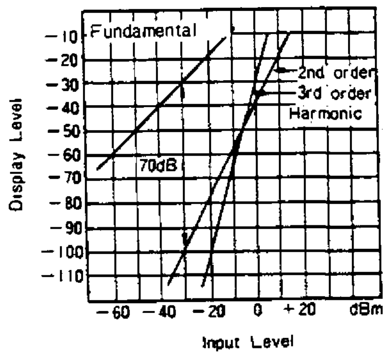


Fig. A-6 Spurious response reference diagram

V.S.W.R. (Voltae standing wave ratio)

It is a constant to represent impedance matching condition and is expressed by a ratio of the maximum and minimum values among the standing waves which are composed by travelling waves and reflected waves at the condition the Spectrum Analyzer is acting as a load to an ideal nominal impedance source. This is another expression of reflection coefficient and reflection loss, which relation is described below.

In the case the signal EO supplied from the transmitter side is completely transmitted to the receiver (a Spectrum Analyzer) without any impedance loss, the signal EI received must be identical to EO. If the signal is not perfectly transmitted due to mismatching, etc. but there are reflected wave received again at the level ER, the reflection coefficient is expressed as follows:

Reflection coefficient m ≈ ER/EO

The ratio of reflected wave ER to travelling wave EO is reflection loss which is 20 log ER/EO (dB)

V.S.W.R. = (EO + ER)/(EO - ER).

The relationship with reflection coefficient is:

V.W.W.R. = (1 + |m|)/(1 - |m|)

V.S.W.R. is in a range from 1 to indefinite, and the matching is better as V.S.W.R. is close to 1.

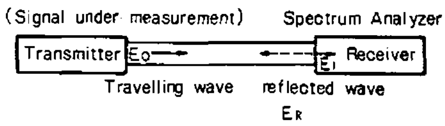
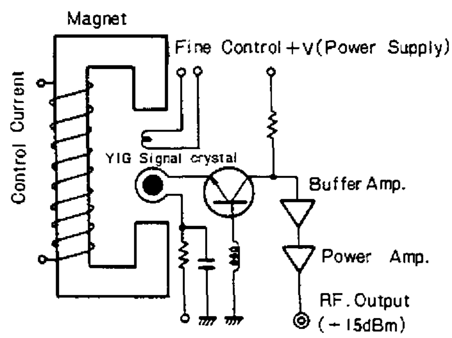


Fig. A-7 V.S.W.R. reference diagram

YIG-tuned oscillator

YIG-turned Oscillator was reported by Griffiths in 1946 for the first time. Ferite in Garnet representing YIG (Yttrium Iron Garnet) single crystal has an extremely sharp electro-spin resonance in frequency has a linear proportional relationship with the impressed DC magnetic field over a wide frequency range. It enables wideband electronic tuning by varying exciation current of the magnet which causes a DC magnetic field. ADVANTEST uses YIG Oscillator for the local oscillators of its Spectrum Analyzers and TR5200 series Automatic Microwave Frequency Counters.



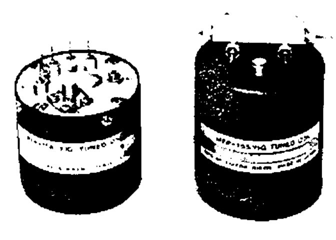


Fig. A-8 YIG-tuned OSC. block diagram

TR4172 Signal Names

Note: Signals Marked with * in the circuit configuration are negative logic.

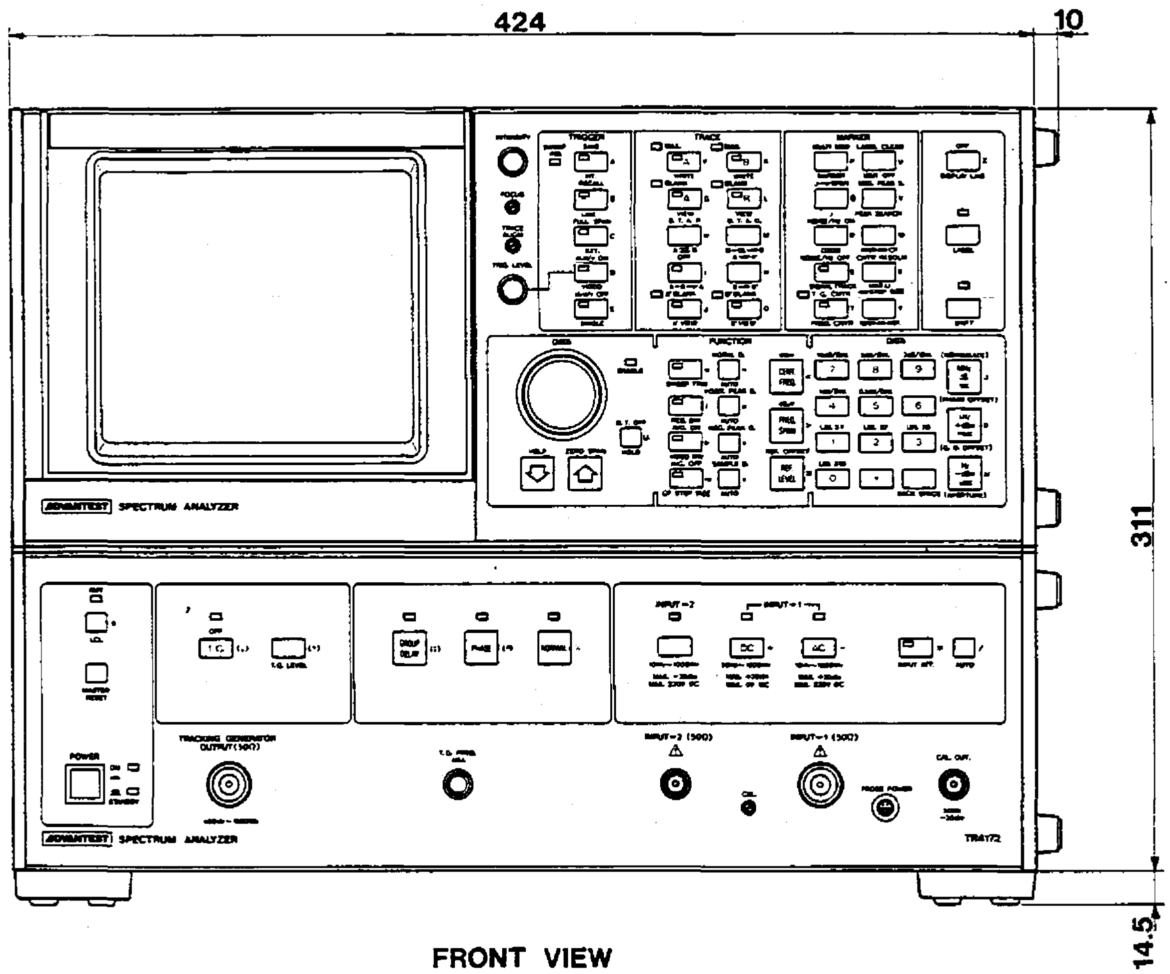
Abbreviations		Signal Name
A	Aa	Address decode out a
	Ab	Address decode out b
	A-D X	A-D X axis
	A. GND	Analog GND
	ANA	Analog
	A. PHASE DET.	Analog phase dectector
	AS	Analog sweep
	AST	Analog sweep trigger
	ASZ	Analog sweep Z (Blanking)
	ATN	Attention
	A WAIT	A wait
B	BRQI	Buss request input
	BRQO	Buss request output
	BUSS ACK	Buss acknowledge
	BUSS OFF	Buss line off
	BUSS REQ	Buss request
C	CADBUS	CPU address buss line
	CAS RESET	Column address strobe reset
	CASSET	Column address strobe set
	CD	Character display
	CDT BUS	CPU data buss line
	CKA	Clock A
	CKB	Clock B
	CKC	Clock C
	CKD	Clock D
	CKE	Clock E
	CKF	Clock F
	CK0-11	Clock 0 - 11
	CNTCK	Counter clock
	CNT. INT	Counter interrupt
	CON	Control
	CREAD	Character Read
	CROM	CPU ROM
	CROMCNTE	Character ROM counter end
	CS	Chip select
	CSAD	Chip select A-D
	CSAIO	Chiup select analog I/O
	CS ATT	Chip select ATT I/O
	CS CHARA	Chip select character
	CSDA1	Chip select D-A 1
	CSDA2	Chip select D-A 2
	CSDA3	Chip select D-A 3
	CS GPIB	Chip select GPIB
	CS IF	Chip select IF
	CSIZE	Chacter size
	CSKEY	Chip select key
	CS LOG	Chip select LOG AMP

	CS MK1	Chip select marker 1 (CSMARK1)
	CS MK2	Chip select marker 2 (CSMARK2)
	CSM1	Chip select memory 1
	CSM2	Chip select memory 2
	CSNMI	Chip select non mastable interrupt
	CS0	I/O chip select 0
	CSPOSI	Ship select position
	CS RAMP	Chip select ramp generator
	CS TG	Chip select TG
	CS TIME	Chip select timer LSI
	CS XY	Chip select XY recorder
	CS YIG	Chip select YIG I/O
	CS 3RD	chip select 3rd local I/O
	CX	Character X axis
	CX OUT	Character X axis output
	CY	Character Y axis
	CY OUT	Character Y axis output
D	DAV	Data valid
	D GND	Digital ground
	DL0-7	Display LED number
	D PHASE D	Digital phase detector
	DR0-7	Display return line number
	DS0-38	Display scan line number
E	EN1	DATA knob 1
E	EN2	DATA knob 2
	EOI	End or identify
F	FL number	Filter
G	GD	Graphic display
	GDZ	Graphic display Z
	G1	Grid number 1
	G2	Grid number 2
H	H	Heater
	HRAS	Hard row address strobe
	HV	High voltage
	HWR	Hard write
	HWAIT	Hard wait
I	IADBUS	I/O address buss
	IDTBUS	I/O data buss
	IFC	Interface clear
	IHDATA	I/O hard data ebable
	IND	Indicator
	INT	Interrupt
	INTE C	Intencity control
	INTEND	Interrupt sweep end
	INT GPIB	Interrupt GPIB
	INTKEY	Interrupt key
	INT OP	Interrupt option
	INTQP	Interrupt quasi peak
	INT STOP	Inetrrupt sweep stop

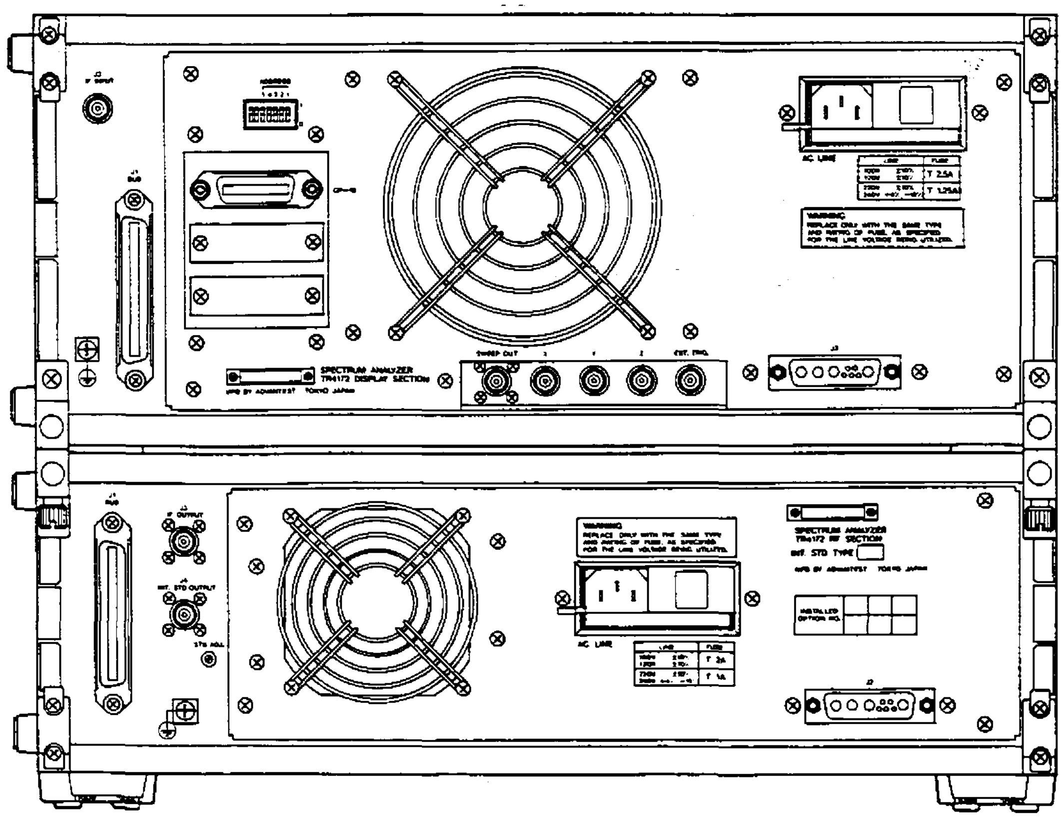
	IOCS0	I/O chip select 0
	IORQ	I/O request
	IOM1	I/O request M1
	IRD	I/O read
	IROM	I/O ROM chip select
	ISO AMP	Isolation amplifier
	IWR	I/O write
K	K	Kasode
L	LDZ	Line display Z
	LG	Line generator
	LGZ	Line generator Z
	LEIND	LED Indicator
M	MAG OUT	Magnifier amplifier output
	MAIN LCL	Main latch clear
	MARK RESET	Marker reset
	MA0	Memory address 0
	MDT BUS	Memeory data buss
	MMD	Marker memory data
	MREQ	Memory request
	MRD	Memory read
	MST	Master reset
	MWR	Memory write
N	NDAC	Not data accepted
	NRFD	Not ready for data
	NT	Non trigger (NONT)
P	PDOWN	Power down
	PG	Pulse generator
	PNMI	Power down non mastable interrupt
	POSI	Position
	P1	Plate no.1
	P2	Plste no.2
R	RAMCNTCK	RAM counter clock
	RAMCNTE	RAM counter end
	RAMP X	Ramp X
	RAMP Y	Ramp Y
	RAS (MRAS)	Row address strobe
	RD	Read
	RD1-3	Read 1-3
	REN	Remote enable
	RFSH	Refresh
	RL0-4	RF LED 0-4
	ROMCLK	ROM clock
	ROMCNTCK	ROM counter clock
	ROMCNTCL	ROM counter clear
	RR0,1	RF return line
	RS40-68	RF scan line
S	SD	Spectrum display
	SD Z	Spectrum diaplay Z

	SRQ	Service request
	SWEEP (M)	Sweep main
	SW IND	Switch indicator
T	TUNE (M)	Tune main
W	WAIT	Wait
	WR	Write
	WR1,2,3	Write 1,2,3
X	XCNTCL	X counter clear
	XL	X line axis
Y	YL	Y line axis
Z	Z	Blanking
	Δ Y	Delta Y
	4µCK	4 µs clock
	1MHz	1 MHz clock
	$\bar{\Phi}$	Clock

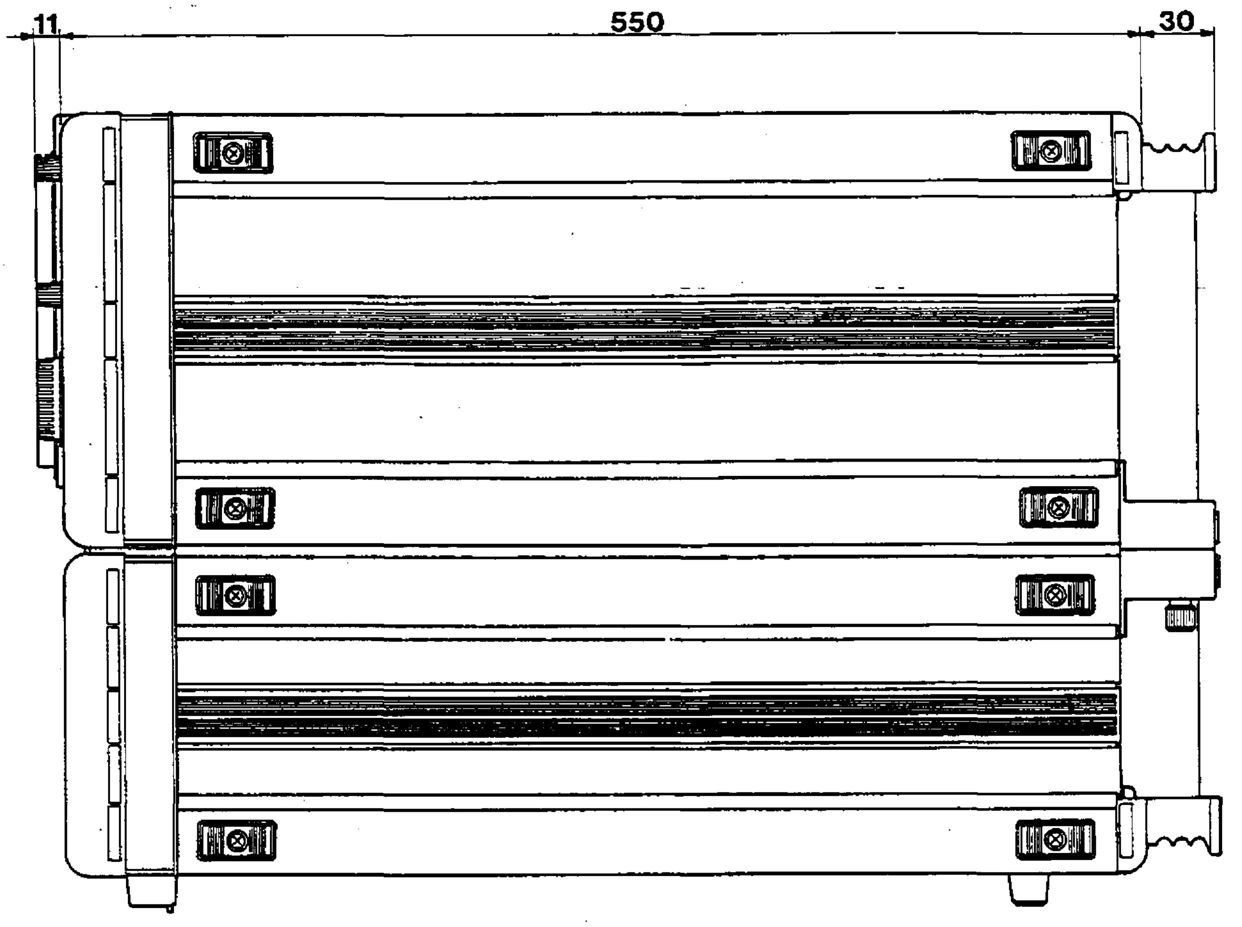
MEMO



FRONT VIEW



REAR VIEW



SIDE VIEW

TR4172
EXTERNAL VIEW

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